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Concerning Vaccination.

A CRITICAL EXPOSITION OF THE SUBJECT

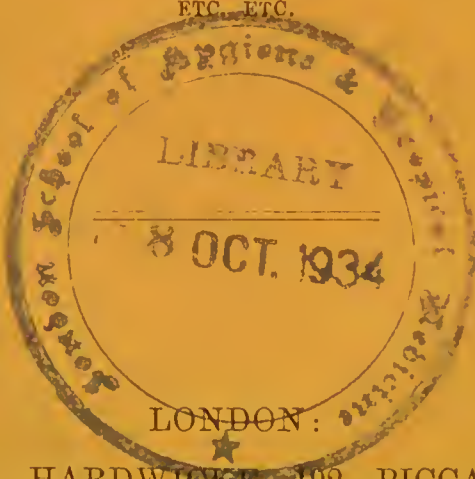
FOR

NON-PROFESSIONAL READERS.

BY

GEORGE EASTES, M.B. LOND. F.R.C.S. ENG.

ETC. ETC.



LONDON: ★

ROBERT HARDWICKE, 192, PICCADILLY.

1871.

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P R E F A C E.

THE uninviting subject of *Smallpox* has unfortunately for some time seriously occupied public attention; and cannot yet be lightly dismissed, although there is the inclination to cry "enough, enough." In order to allay unnecessary panic, and to arrest the onward march of the epidemic now in progress, there must be wider diffusion of sound information concerning its nature and the measures best calculated to check it.

For five months the weekly mortality from smallpox, in London alone, has averaged two hundred and thirty; all, be it remembered, deaths produced by the most avoidable of the eruptive fevers, and the melancholy result of ignorance and wilful neglect of the means by which immunity may be secured.

Acts of Parliament already render the single known barrier against the disease—*Vaccination*—compulsory in infancy; but they, and other such beneficial enactments, are apt to remain largely inoperative, unless advantage is clearly seen to follow their observance.

Again, the *Re-vaccination* of adults, which is only secondary in importance to infantile vaccination itself, is, by the Legislature, left entirely to individual discretion (or indiscretion?); although its neglect, which, from sheer popular ignorance of its necessity, is un-

fortunately very common, often entails deadly consequences.

Further, the scientific problems pertaining to Smallpox and Vaccination are of such interest in themselves that they claim to be understood of every intelligent person. On the other hand, non-acquaintance with the subject leads to deplorably fatal results; since it permits the prevalence of prejudices which, once begotten, feed on rumours the most extravagant, and much too frequently result in determined opposition to vaccination.

The present year has been prolific in pamphlets written to instruct the public upon its dangers and duties in this matter; but the said public needs still greater rousing from its indifference to the ravages of Smallpox. The popular ignorance and unconcern; the prevalent prejudices and delusions; the spoken and published untruths, beyond all numbering; the open opposition to the compulsory provisions of the Vaccination Act—all call aloud for further spread of knowledge. And each fresh publication, if it supplies correct opinions upon the subject to only a fraction of the community, will yet, within that small circle, probably save life. Wherefore, welcome every attempt to make known the truth respecting this very vital question!

The special aim of this contribution is to provide a simple *résumé* of the whole case, of all that is said for or against Vaccination; it is intended to form a rough sketch, not an exhaustive treatise. That it may be accessible to those who desire precise information thereon, the author has, as much as possible,

avoided medical technicalities and phraseology, and the work is issued at the very lowest remunerative rate.

To all who are conversant with the points of this much-discussed theme it need scarcely be notified that but little novelty can be expected to adorn the repetition of the already more than thrice-told tale, the elements of which have been known since the commencement of the century. Therefore, if these pages are searched in the old Athenian fashion for "some new thing," disappointment will probably result. Nevertheless, recent views and statistics have received due recognition.

And now, in ending these various topics which it seemed desirable to place together in a Preface, one may be allowed to express the ardent wish and hope that the Truth, whoever speaks it, may prevail, and falsities, whether of inadvertence or wilfulness, be in time consigned to

"The swallowing gulf
Of dark forgetfulness and deep oblivion."

LONDON, *July*, 1871.

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CONCERNING VACCINATION.

1. To form an accurate judgment of the value of vaccination, one must already possess some precise knowledge of smallpox and its prevalence before the introduction of vaccination. The supply of this necessary information will naturally form the first stage of the present inquiry.

2. SMALLPOX (*Variola*), one of the eruptive fevers, is a disease to which the human body at all periods of life, with certain exceptions, is liable. It seems now to be invariably produced in an individual by the introduction into his frame of a poison generated by the body of some other person suffering from the disease ; and that poison, once introduced, undergoes immense multiplication in its new home, so that the organism becomes thoroughly drenched with it. Its reproduction in the blood seems analogous to the increase of yeast by fermentation in a solution of sugar.

3. It is not needful to the present purpose to discuss critically the absolute nature of smallpox poison, except to say that "*it consists probably of minutest particles capable of being freely wafted by air ;*" still, a few of its chief characteristics must be enumerated. Probably it is formed and exists in greatest quantity in the eruption on the skin and lining membranes of the patient, though there is reason to believe he may convey the disease to others whilst as yet the erup-

tion has not appeared upon himself. Thence the poison diffuses itself through the surrounding atmosphere, or may be conveyed to a distance in contact with articles of clothing, &c., each of which, as long as any poison remains with it—probably a period of years, if the article be stowed away—will upon exposure form a fresh source for contamination of the adjacent air. There is evidence that the temperature of boiling water does not destroy the virus; hence the necessity for most careful disinfection of the invalid's clothing by chemical agents as soon as it leaves him. The capability of infecting remains with the corpse even for many days after death. Such, in fact, is the subtlety of the poison, that Sir Thomas Watson says of it: "there is no contagion so strong and sure as that of smallpox: none that operates at so great a distance." And Mr. Simon observes that "it seizes, with very few exceptions, on all who for the first time come within its range." This range is supposed to be "something under fifteen yards."

4. The atmosphere of the chamber of a person suffering from variola, though it remains colourless, has at a certain stage of the disease a peculiar sickly odour—once experienced, not easily forgotten; the presence of which, whether it is caused by, or merely accompanies, the poison itself, indicates the tainted condition of the air. This odour lasts but a few days, and it is highly doubtful if the keenest nose can detect its conveyance with infected clothing to a distance. With this temporary exception, there is unfortunately no change perceptible to the unaided senses, to indicate the pollution of the atmosphere through which smallpox poison is diffused. If only the virus had a coloured tinge (purple or red, for instance), or were turbid, like smoke, how very anxiously its spread in an epidemic would be watched. Each patient would then be seen to be surrounded by a globe of coloured poison-laden air, concentrated towards the

centre, fading away at the circumference into the general atmosphere, and probably, beyond a distance of fifteen yards, becoming ordinarily too dilute to affect people prejudicially. When undisturbed by currents, the sphere would reach equally in all directions from the patient; but with draughts it would be shortened in a direction contrary to the wind, and elongated at the opposite side. An ordinary house, under such circumstances, containing a case of small-pox, would be visibly pervaded throughout with a purplish atmosphere, that would be noticed streaming from the open doorways and windows with all outgoing aërial currents. Can it be imagined how eagerly such a place would be shunned? And yet, with the exception of the colour, such is the exact condition of things obtaining now in numberless habitations of this metropolis, the residents in which (in the poorer districts, at any rate) permit the free entry of their friends and neighbours for the sake of gossip only.

5. Of course the difficulty in detecting the presence of variolous material in the air renders it often impossible to decide where an individual may have contracted the disease; and hence occasionally a case may almost seem to have originated in itself. But it is nearly certain that the malady never now comes to any one except it be conveyed from a person previously ill of it. For instance, it is never known to spring up afresh in isolated communities, enjoying but restricted intercourse with the rest of the world. In them its presence is always the result of introduction from without, usually in the person or clothes of a sailor sent ashore with the complaint. Thus, after the discovery of America, smallpox, previously unknown to that continent, was imported from Europe, and soon spread with such virulence that in some places the country was quite depopulated.

6. How smallpox first came about, whether, as is

by some supposed, it originated with the lower animals,—for there is a distemper resembling it amongst sheep,—and was thence communicated to man, or whether it began in a combination of physical and chemical conditions which may, or may never, recur,—these are problems partly buried with the past, into which one need not here enter. Unhappily, there is always a sprinkling of cases through the world, each of which forms a centre for the infection of other folk.

7. But besides its conveyance in the “air we breathe,” when in all probability it enters the system by the lining membrane of the respiratory tract in the nose and lungs, smallpox may be communicated through the skin (inoculation). The course of the disease is then much modified,—a point to be presently discussed.

8. Now, let it be supposed that some one receives the poison through the air, and that the variolous process commences with him. The tedious and perilous journey to be run before his restoration to health is, for descriptive purposes, divisible into four stages, and will be somewhat as follows. At the outset comes an interval during which he may feel quite well, but is usually somewhat indisposed; this lasts eleven times twenty-four hours from the time of infection, and is the first stage, or period of latency or incubation. Thus, any one (see diagram, page 27) poisoned on Thursday, the 1st of the month, feels scarcely anything amiss with himself until Monday week, the 12th. The second stage then begins, and is characterized by these phenomena: vomiting; pain in the back; drowsiness, amounting sometimes to complete insensibility; and, at first, severe shivering, to be shortly followed by all the indications of high feverishness. After about forty-eight hours, when the specific rash appears, the third stage of his illness begins. It is marked by abatement of the feverish

symptoms, and by the cropping-out of the eruption in successive batches. As the severity of the disease corresponds closely with the copiousness of the rash, a short description is required of the course pursued by one of the many eruptive blotches; which may serve as a type of what takes place all over the patient's body.

9. First appears a red pimple, small as a pin's head, but which gradually enlarges. Beneath its point in about thirty to thirty-six hours a little colourless transparent fluid, called "*lymph*," may be seen; in medical language the "*pimple*" has become a "*vesicle*." The vesicle, bound down and depressed at the centre of its surface, and surrounded by an inflamed patch of skin, simply increases in size for four or five days; then, beneath and around its base some liquid yellow material, "*pus*," is visible—the "*vesicle*" has advanced to the stage of "*pustule*." The contents of the pustule are the deeper cell-layers of the scarf-skin softened and multiplied by the inflammatory process; whilst the subjacent true skin becomes red, swollen, and painful. The patient now presents a sadly disfigured appearance. If the pustules are numerous, his head and neck are swollen, his eyelids being often quite closed. In seven or eight days from the commencement of the eruption the pustule is at its worst; the covering of thin scarf-skin bursts, purulent lymph exudes, and, drying, forms a crust; the pustule soon shrivels, and the inflammation ceases. In five to nine days more the crust falls off, and a red ulcerated patch remains, which soon skins over. But the site continues visible for weeks as a mulberry-tinted stain, that gradually fades and eventually becomes the white irregular scar known as the *small-pox pitting* or mark. Such is the usual course of one pustule; and the pustules may vary in number from tens only to thousands, one-fifth of the whole number being generally seated on the face. When very nu-

merous, they run one into the other ; the inflammation and destruction of the skin are proportionately severe, and, if recovery in such a case ensue, deep indeed are the pits with which the skin is scarred.

10. These consecutive changes in the eruption are accompanied by corresponding variations in the constitutional condition of the patient. When the "vesicles" are changing to "pustules," *i.e.* about the sixth day of the rash, feverishness, which had ceased, returns, reaches its height about the ninth day, continues severe during two or three days more, and then slowly disappears. This is the fourth stage, or stage of secondary fever; the most fatal period in smallpox. Death may result from any one of many complications that are then apt to occur. If the patient just escapes the fatal termination, "the struggle is sharp and the convalescence often long. In its progress an endless series of abscesses may take place and produce lameness; ulceration of the cornea" (transparent front portion of the eye) "causing blindness, or inflammation of the ear causing deafness, may also ensue; while the deeply-scarred face is a lasting record of the severity of the disease, and of the great danger the patient has survived."—(*Aitken.*)

11. But why dwell on these sad details? Simply because they are apt to be forgotten. People at the present day, seeing cases of smallpox but rarely, are liable to under-estimate the gravity and loathsomeness of the disease, and to neglect the means which are at hand for its prevention. However, one must not anticipate.

12. With the foregoing as the description of a typical case of variola, it will be readily perceived that the invalid experiences a long train of troubles and annoyances, absolutely in his own body, and conjointly with other men, from the restrictions necessarily placed upon the usual intercourse between him and his friends. The latter and less grievance may be

shortly dismissed. He is prevented from following any public occupation during the illness; and, even for many weeks after the establishment of convalescence, when he feels sufficiently strong in himself to return to his vocation, yet does his blotched appearance render advisable further absence from all duties that require personal attendance upon any class of the community. Thus, his pecuniary loss alone is likely to be considerable. The house in which he is known to be ill becomes shunned, to the detriment of its business or hospitality; whilst the patient, and those who continue to reside with him, find themselves isolated from their friends, who probably will not be prevailed upon to revisit their abode until it has been thoroughly disinfected. These are, however, amongst the lesser miseries to which the invalid is subjected: others, far more serious, he experiences bodily.

13. Let the attack be as mild as possible, he still feels very unwell during some days, is weakened, and requires four or five weeks at the least ere his health is re-established. With increased severity of the disease comes augmented misery during its progress, and a protracted convalescence of months, during which some of the many complications above recorded—leading to permanent impairment of the eyes, ears, joints, &c.—are liable to occur. Life may hang tremblingly in the balance for days, and the invalid eventually escape with it, but so scarred and maimed that death itself seems preferable. Lastly, the proportion of fatal cases is very high, as all statistics show.*

* Macaulay, in describing the death of Queen Mary, wife of William III., in 1694, from smallpox, remarks that it “was then the most terrible of all the ministers of death. The havoc of the plague had been far more rapid; but the plague had visited our shores only once or twice within living memory, and the smallpox was always present, filling the churchyards with corpses, tormenting with constant fears all whom it had not yet stricken, leaving on

14. Papers of the Board of Health, presented to Parliament in 1857,* give the death-rate in more than 90,000 well-observed cases of smallpox since the year 1800 in different countries as ranging from $14\frac{1}{2}$ in 100 (Carinthia) to 60 in 100 (Philadelphia); the general average being about 30 per cent. At which rate, *to 1 of every 3 persons attacked is the disease fatal.* Of 9,000 patients at the London Smallpox Hospital, from 1836 to 1856, 35 per cent. died. Statistics of the same institution for last year show that in 1870 322 persons were admitted, and that 38 in every 100 of those were fatal cases.† The average mortality of different years varies much. Generally, it is higher in epidemics than at times when smallpox is not very prevalent.

15. Enough then has surely been said to justify one in affirming that, “in the universality of its diffusion throughout all countries, and its prevalence in all climates; in the facility with which it is communicated in a variety of ways, and for a length of time; in the remarkable susceptibility to the disease under which nearly all unprotected persons labour; in the painful and loathsome character of the symp-

those whose lives it spared the hideous traces of its power, turning the babe into a changeling at which the mother shuddered, and making the eyes and cheeks of the betrothed maiden objects of horror to the lover.”

* Would that the eloquent, comprehensive, and convincing introduction to these State Papers, written by Mr. Simon, the talented medical officer of the Privy Council, were printed in an inexpensive handy shape, and circulated through the land! Its statistics and arguments would assuredly dissipate much of the pernicious nonsense which is commonly heard in controversies upon the vaccination question. The blue-book is published by Messrs. Longman & Co.

† It must be particularly remarked that all the foregoing observations and statistics apply to cases of primary smallpox; not to those that have previously suffered from the disease, nor to vaccinated cases.

toms which attend it; in the remarkable fatality of severe forms of the disease; and in the distressing life-long evils which it so frequently entails on those who survive its attack,—there is no disease which can be compared with smallpox.”

16. Now, to the relief of humanity, when suffering from such a pitiless pestilence, what can medicine bring? The answer, alas! cannot but disclose the extreme poverty of the physician's resources against the disease once actually established and in progress.* No man, as far as is at present known, can then render decisive assistance to the patient. No medicines materially check the feverishness, or infallibly moderate the eruption or its resultant markings. The physician can prevent the injudicious harmful interference of ignorant sympathizers, and can direct the use of various measures tending to the comfort and general well-being of the invalid; but, beyond this, his influence is very uncertain.

17. Despite these facts, however,—melancholy as they once were for the human race—a brighter view of the subject remains. Two points in the history of smallpox are yet unnoticed. Variola, in common with the other eruptive fevers, scarlatina, measles, &c., has this characteristic; *one attack usually renders the patient incapable of undergoing the fever-process a second time*, or, in other words, “protects” him from future assaults of the same disorder. With smallpox this rule is more constant than with either of the other fevers; very rarely, especially if the first attack be severe, does an individual experience a repetition of the disease.

* As will be presently explained (section 40), during the first day or two after exposure to infection, relief may perhaps be given by vaccination. But, as the patient usually feels quite well at that time, and therefore sees not the necessity of applying for medical assistance, he unconsciously drifts-on defenceless into smallpox.

18. And, if a second attack does happen to him, it is almost certain to be of a mitigated character; the symptoms are mild, and the illness is much sooner ended. In fact, when the eruption arrives at the vesicular stage, the disease generally progresses no further, but begins to retrograde. Complete inflammation of the vesicles does not occur; but they dry up and never become pustules. Therewith comes but little or no secondary fever; and the patient may quite recover in a fortnight or three weeks. It may be that he feels but little unwell, even whilst the malady is in progress; and that scarcely any scars subsequently remain. This is *mitigated smallpox*, which will be further alluded to (section 38). Although most of the cases of secondary variola are of this character, yet it must be distinctly understood that *all are not thus mild*.

19. INOCULATION.*—Another noticeable feature of variola is that when the poison is placed beneath the skin by puncture, the subsequent illness differs considerably from that following the reception of the poison through the air. In other terms "*inoculation*" produces a greatly modified form of smallpox. By the fourth or fifth day from the performance of the operation, the site of puncture is inflamed, and a vesicle filled with lymph commences to form upon it. On the seventh day the skin around the vesicle becomes inflamed: a red *areola*, as it is called, is produced. And now, general feverishness begins; that which in natural smallpox commences on the twelfth day after infection, comes in the inoculated variety on the seventh or eighth day. It remains for about forty-eight hours; then the general eruption

* Inoculation. "*In*," upon; "*oculus*," an eye. The horticulturist inserts buds, as eyes, upon a stock; as the surgeon used to insert the smallpox into the human subject.

appears. The pustule at the punctured spot is already drying up before the secondary pustules are fully distended. The primary fever in inoculated variola is moderate, and as the number of general pustules averages less than forty, the secondary fever, which is usually proportionate to the amount of skin-implication, is equally diminished in intensity, being often almost imperceptible; *the whole disease, in fact, when thus caused, is usually very mild.* Guesses in number have been hazarded in explanation of these phenomena; but a satisfactory interpretation of the facts is still wanting. Dr. Tanner states that "the reports of the Smallpox Hospital for 1797, 1798, and 1799, show that among 5,964 cases of the inoculated disorder there were only nine deaths, or one in 662; and this appears to have been the average mortality." Here then was apparently a means by which the ravages of smallpox were capable of being kept within bounds.

20. After the introduction of the practice of inoculation into England by Lady Mary Wortley Montagu, from Adrianople, in 1717, it grew rapidly in favour; so that by the end of the eighteenth century it was very commonly performed. But two serious drawbacks diminished its popularity. The operator could not insure that his patient would recover; though, by choosing the virus from a mild case, by introducing it at one puncture only, and by selecting a time for the operation when the individual was in the best of health, the risk could be reduced to a minimum. Secondly, the person inoculated formed a centre for the infection of others, and, although he himself had the disease most mildly, yet he might propagate a fatal variety of smallpox. There seems certainly to have been less likelihood of the spread of infection from an inoculated case than from a person suffering from natural smallpox; still the risk run by the community was considerable. In Mr. Marson's words,

“although the practice was of great advantage to individuals, it was very destructive to the public at large, and the general mortality from smallpox was thereby greatly increased.” For these among other reasons, inoculation, in 1840, was made illegal in England, and punishable by a month’s imprisonment.

21. VACCINATION.*—A disease of the milch-cow, characterized by some feverishness, and an eruption on the skin resembling that of smallpox in man, came, in 1768, under the notice of Edward Jenner, a surgeon’s apprentice in Gloucestershire. It was known that the malady (cowpox, as it was termed) was communicable from the cow to man, and from man back again to the cow; and there was a popular opinion in the dairy districts that persons who had once suffered from the disease were afterwards incapable of undergoing smallpox. At the investigation of this opinion Jenner patiently laboured, and gave to the world in 1798 a pamphlet containing the report of 23 carefully-observed cases of people who, in his own knowledge had suffered from cowpox (*Vaccinia*) and afterwards seemed proof against smallpox. This modest production, of seventy-five pages only, which was to win for its author the immortal fame of being one of the greatest benefactors to mankind, contained the gist of all that has since appeared upon the subject of vaccination.

22. Having satisfied himself of the fact that those who contracted vaccinia in the dairies from the animals could not be subsequently inoculated with variola, Jenner next transferred the cowpox lymph from child to child; he found that the disease in the last of a series of five children so affected differed apparently in no essential respects from the cowpox of the first, and

* “*Vacca*,” a cow.

that all five were equally protected against smallpox. He then conceived the brilliant idea that vaccinia might be transferred indefinitely from man to man, by the hand of the surgeon, that the whole human race might by this simple means gain immunity from the most fatal pestilence then raging, and smallpox be in time suppressed. And seventy-three years have but tended to confirm in almost all points the truth of the doctrines which Jenner enunciated.

23. At a certain stage of the eruption in the cow a few drops of lymph can be obtained from the vesicles; and if this lymph be placed in contact with a fresh scratch in the skin of a human being, there is produced in that individual the same disease as existed in the animal—*cowpox* or *vaccinia*. The most noticeable feature of the induced disease is the skin affection at the site of puncture, which pursues a course almost identical with that of the small-pox eruption.* Each punctured spot, on the arm of an infant, for example, becomes on the third day a little elevated (is a *pimple*); by the fifth day the elevation contains some clear lymph, which increases daily, and gradually becomes opaque. The centre of the *vesicle* is on the eighth day markedly depressed; and the ring of skin around and beneath it is inflamed, forming the “*areola*.” After the tenth day the redness and swelling subside, the vesicle usually having just previously burst and discharged. The remaining lymph, turbid, and mixed with inflammatory products (the pustular stage), dries up, forming a blackish, circular crust, that falls off about the twentieth day. A permanent, circular, pitted scar remains, the result of the destruction of skin which has occurred, and which may be accepted as an indication that the whole body has been affected by the vaccine

* The resemblance will be apparent if the description of the latter, already given, at section 9, be reverted to.

process. From about the sixth day to the tenth or eleventh, the child has a little pain in the arm and adjoining armpit (in which are situate certain glands that now manifest a slight temporary inflammation because they are nourished by fluid coming to them from the inflamed arm); he is also a little feverish, has headache, some shivering, loss of appetite, &c., proofs that the vaccination is influencing his constitution; and he commonly has a general faint eruption for a few days. Such should be the progress when the operation is for the first time performed; it being laid down as a dogma by an eminent authority, Dr. Seaton, that "a vaccination presenting any deviation from the perfect character of the vesicle, and the regular development of the areola, is not to be relied on as protective against smallpox."

24. It will be noted that, although vaccinia bears a general resemblance to smallpox, yet are the differences equally marked; so that in the popular mind they are considered perfectly distinct affections. In cowpox there is usually nothing comparable to the general eruption of variola, nor is the constitutional disturbance produced by any means so severe as in natural smallpox; and whilst the latter is certainly one of the most infectious maladies known, it was never heard that vaccinia could be caught through the air. In this last characteristic lies its grand distinguishing feature, the property for which it is universally preferred to variolar inoculation. In this respect, too, vaccinia resembles all the other human diseases known to be derived from the lower animals, as hydrophobia, glanders, &c. They are all propagated by contact, and not by atmospheric diffusion. On the other hand, the highly infectious character of smallpox certainly raises the presumption that it (contrary to the opinion of many eminent authorities) did not so originate.

25. The results of re-vaccination are much less uniform. Firstly, no action may show itself at the site of

puncture; this occurs in about five per cent. of re-vaccinations performed by careful operators. And if even these cases be again vaccinated by the same gentlemen with other lymph, or by other operators, some will probably be found to "take"; a proof that the impediment resided in the operator or his lymph. In a second class of re-vaccinations the effect is a pointed vesicle (instead of the vesicle with depressed centre), the contents of which are drying as early as the fifth day, with but little inflammatory areola or constitutional disturbance. In 40 per cent. the result is a good "take," which runs its various stages as in primary vaccination, except that its course is usually accelerated, so that the height of the inflammation may be reached by the sixth day, seventy-two hours earlier than with primary vaccination. The constitutional symptoms of re-vaccination vary also as much as the local. They may be scarcely noticeable at all; or, the person may be a little feverish and upset for three or four days, as in primary vaccination. Usually, the more nearly perfect is the vaccination the greater is the amount of constitutional disturbance.

26. Fortunately, the vaccine poison inserted into the arm is, as in the similar case of smallpox, immensely multiplied in the general system; the increase being most visible, however, at the site of operation. At about the end of a week the vesicle resulting from each puncture is filled with lymph, in which float transparent particles of microscopical minuteness, and it is soon burst by its own contents. Frequently, from one "good arm" as many as twenty children or adults may be vaccinated. Did not such local, visible, and easily accessible increase of the virus take place in man, recurrence must be had, for each vaccination, to the cow itself; whole tribes of people (where cowpox is uncommon) would be unable to avail themselves of Jenner's discovery, and smallpox would still be rampant. As it is, no station is so remote that vaccine

virus, properly preserved, cannot be procured from another quarter.

27. Vaccine poison does not appear to suffer deterioration by its transmission through generations of human beings, if care is exercised to take it at the proper time, and to use it whilst fresh. (See also section 69.) When, however, ingrafted upon man direct from the cow, the disease is not in the first few of the series so uniform in its progress as it subsequently becomes, when it is acclimatized, as it were, to its new situation. Other serious objections to the use of lymph direct from the cow will be more conveniently noticed hereafter (section 90).

28. Lymph for vaccination should always be taken from the vesicle of a *primary* vaccination, not later than the *eighth* day; *i.e.* the day week after the vaccination. The vesicle of re-vaccination being usually modified, it is natural to suppose that the contained lymph is modified and liable to impart, not true cow-pox, but a modified disease. And if the lymph is taken before the eighth day, only a little can be obtained, though that on the seventh day is, at any rate, equally efficacious as eighth-day lymph. After the eighth day, when the areola has formed, and the lymph is mixed with other products of inflammation, if it (the lymph) is then used, it is apt to produce more than the ordinary inflammation in the arm vaccinated with it, and does not give so good a vaccine vesicle.

29. Where possible, lymph should be used direct from arm to arm. When this practice cannot be followed, it may be kept stored in hermetically-sealed capillary tubes for months without its undergoing any loss of virtue. If it is to be used within two or three days, lymph may be collected on ivory points or between little squares of glass, in which situations it necessarily dries by evaporation. The results of primary or secondary vaccination effected with such dried lymph are as satisfactory as when the operation is per-

formed with liquid virus, provided the operator be sure to dissolve the dry material in the drop of blood that oozes from the puncture, and cause it so dissolved to come in contact with, and actually poison, the wound in the skin.

30. Another mode of vaccination has been lately recommended by Mr. Ellis. Three or four pieces of blistering substance, each as large as a pin's head, are held by plaster in contact with the skin for a whole night. In the morning three small blisters have arisen. Into each of these an ivory "point," coated with fresh lymph, is thrust, and there held for a minute or so. The lymph is dissolved off, and the abraded spot thus poisoned "takes" thoroughly. But as two visits to the surgeon are required to complete the operation, this, the "vesicatory," plan is not likely to become popular. It may be added that the experience of its originator is altogether favourable; but further trial must precede the final verdict of the profession.

31. Hitherto, separate mention has been made of natural and inoculated smallpox on the one hand, and of vaccination and re-vaccination on the other; it remains to speak of the relationship existing between them. Jenner, as the result of his investigations, concluded that the smallpox of man and the true vaccine disorder of the cow* are one and the same disease; for which reason he named the latter "*Variolæ Vaccinæ*"—cow smallpox.† Experiments, since

* The cow is affected with other pustular eruptions somewhat similar to "*Variolæ Vaccinæ*," which, for vaccinal purposes, must be most carefully distinguished.

† Another topic, which, however, more closely concerns the theory than the practice of vaccination, requires some mention. Jenner thought the disease of the horse, called "*grease*," was due to the same poison as smallpox and cowpox. He traced the transference of "*grease*" by the hands of stable-men tending horses affected with it to cows, which those same men milked, with the

his day, have been conducted with great care, in different parts of the world, to determine this point—with these results: It is found very difficult to inoculate cows with the virus of *human smallpox* successfully, and numerous are the failures recorded. But when success attends the operation, there is produced upon the cow, *not smallpox*, but the true *vaccine* disease, which although contagious is not infectious, and which has markedly local rather than constitutional signs and symptoms, from the vesicles of which other cows may be successfully *vaccinated*. And if the virus be ingrafted back again upon an unvaccinated and unvariolated person, the disease conveyed is vaccination, not smallpox. A cow once vaccinated cannot, in general, be again successfully inoculated with smallpox or vaccine virus; and, in broad terms, a human being once thoroughly vaccinated, or having

result that "*variolæ vaccinae*" was caused in the cows, and that it soon afterwards appeared on the hands of the milkers. He found that the men were subsequently incapable of taking smallpox. It has been further shown that the inoculation of "grease" lymph produces upon human beings vesicles that cannot be distinguished from vaccine vesicles, and that it affords a like immunity from variola. Whether "grease" or cowpox ever now originates spontaneously in the quadrupeds it affects is perhaps a question; and how "grease" spreads from horse to horse, whether through the air, as does human smallpox, or by contact only, as does human vaccinia, the author cannot learn. Cowpox, according to Mr. Ceely's observations, is—usually at any rate—the result of transference of virus upon the milkers' hands from diseased cows to healthy ones; in which respect it certainly resembles human vaccinia rather than smallpox. At present all vaccine lymph, when required from the lower animals, is obtained from the cow; so that one may here dismiss from further discussion the subject of "grease," merely remembering it as another source of "*variolæ vaccinae*" for the cow, if ever, a most improbable occurrence, failure in the supply of vaccinal lymph were to come to pass. A practical comforting reflection for mankind, amidst all this change and communication of disease from one to the other animal, is that smallpox, at any rate, is not known in the present day to come to man from any other creature than one of his own species.

undergone smallpox, cannot be again made the subject of either disease. Each malady is protective of the other. Facts, therefore, would appear to warrant the conclusion that *cowpox is not smallpox, but a modified form of that disease, the two being seemingly dependent upon varieties of the selfsame poison*. Nor need this much surprise any one who is conversant with the allotropic conditions under which elementary and compound forms of matter exist. Of the two kinds of variolous disease one only seems to be capable of existing in the cow. That form—vaccinia—can be easily inoculated upon the animal when vaccine lymph is inserted into the punctures; whereas the operation is acknowledgedly difficult when the virus of smallpox is used for the same purpose. In the former case, multiplication of the implanted poison seems only to be required; in the latter, there must be modification and multiplication. In man, on the contrary, both forms of the poison are capable of reproduction; and that variety which alone exists in the cow is the form always propagated from that animal to the human species. Happily, no instance is known in man of the one kind of the disease passing into the other. The only occasion of such a change is when smallpox is effectually inoculated upon the cow; then variola becomes vaccinia.

32. It is now necessary to determine the exact amount of protection afforded by vaccination against variola. First, it will be well to compare the death-rates from smallpox of entire populations before and after the general introduction of vaccination (about the year 1800). For this purpose the statistics in the papers presented to Parliament in 1857 are the most compendious and reliable. From them it would appear that in Sweden (in which country the death-rate has been very accurately kept for a century past), from 1774 to 1801, the average annual death-rate by small-

pox per million of living population was 2,050; from 1810 to 1850, the average was 158 only. From 1777 to 1806 in Bohemia, Moravia, and Austrian Silesia 4,000 perished annually of this scourge, where the deaths have been since (1807 to 1850) reduced to 200. In Copenhagen, from 1751 to 1800, the smallpox death-rate was 3,128; from 1801 to 1850 it was only 286. And in Berlin, where the average from 1781 to 1805 was 3,422, from 1810 to 1850 it reached to 176 only. "The fatality of smallpox in Copenhagen is but an eleventh of what it was; in Sweden little over a thirteenth; in Berlin and in large parts of Austria but a twentieth; in Westphalia but a twenty-fifth. In the last-named instance, there now die of smallpox but four persons, where formerly there died a hundred." * In London during the eighteenth century the death-rate from smallpox is considered to have generally ranged from 3,000 to 5,000 per million living; whilst from 1846 to 1855 it was 340. And it must be remembered that these improved proportions occurred in communities but partially vaccinated. When, as is the case with recruits upon entrance into the army or navy, all the population is officially inspected and vaccinated, unless marked with smallpox, a further reduction of mortality to about the fourth of the above-cited London rate occurs. This statement, however, is not quite devoid of a fallacy; for variola is most fatal at the two ends of life, and individuals of those ages are not found in the army and navy.

33. The first and most manifest result, then, of general vaccination is the diminution of mortality from smallpox. Whereupon the obvious query arises, how comes this? Is it because less people are attacked? or, do those attacked suffer less severely? Unfortunately, the registration of sickness that does

* Page 23 of the Papers of the Board of Health.

not end in death is not by law compulsory, so that accurate statistics with which to meet the former query are wanting; but the consideration of the second question will afford grounds for an approximate reply to the first. And here one must again quote from Mr. Simon's report. The three sets of figures, which, being the highest on the list, probably contain the least fallacy, are as follows:—In France, from 1816 to 1841, of 16,397 cases of variola, $16\frac{1}{8}$ per cent. of the unprotected, 1 per cent. only of the vaccinated, died. In Bohemia, 1835 to 1855, the death-rates were respectively $29\frac{4}{5}$ and $5\frac{1}{6}$ per cent. in a total of 15,640 cases; whilst at Milan, 1830 to 1851, of 10,240 observed cases, $38\frac{1}{3}$ per cent. of the unprotected died, but only $7\frac{2}{3}$ per cent. of the vaccinated. At the London Smallpox Hospital, from 1836 to 1856, in 9,000 cases, the averages of deaths were 35 and 7 per cent. in the two divisions respectively. Last year, 1870, 1,284 cases were admitted to the same institution, 322 unvaccinated, and 962 vaccinated; of the former, 124, that is 38·5 per cent., died; but of the latter, 76 only, 7·9 per cent. were fatal cases. Thus all statistics coincide in showing that smallpox after vaccination is a much less fatal disease than is natural unmodified variola (see also section 38). In round terms, 30 per cent. of unprotected cases, 3 to 7 per cent. of vaccinated cases, are fatal. And one may hope, as years roll by, to find even this proportion of deaths much diminished, as the vaccination inspectors lately appointed will see that the population is properly protected.

34. Now, for the former question, the comparative frequency of smallpox before and since the introduction of vaccination. It is a matter of common notoriety that persons thoroughly vaccinated rarely contract variola, so that if, at the beginning of an outbreak of the malady, all persons liable to be attacked are vaccinated, the plague is soon stayed; and it was formerly a matter of fact that persons, unless inocu-

lated, rarely passed the age of forty without having natural smallpox. Some statistics bearing on this point, published by Mr. Cross, are quoted by Mr. Simon. During a severe epidemic of smallpox which prevailed at Norwich in 1819, Mr. Cross "observed 112 families, in all of which there were cases of the disease; and the annexed table," which speaks for itself, shows the result.

	Number.	Cases of Smallpox.	Deaths by Smallpox.
Total number of persons } in the 112 infected } households }	603	202	46
1. Protected by previous } smallpox*..... }	297	—	—
2. Protected by vaccination	91	2	—
3. Unprotected	215	200	46

35. Certain observations by Dr. Seaton confirm this table. During the epidemic of smallpox in London, in 1863, he and Dr. Buchanan examined "upwards of 50,000 children in various national and parochial schools, workhouses, &c. Some of them had never been vaccinated; the large majority had been vaccinated in various manners and degrees. Of every 1,000 children without any mark of vaccination, no fewer than 360 were found to have scars of smallpox; while, of every 1,000 children who had evidence of vaccination, only 1.78 had any such traces. But this statement is far from expressing the whole difference; for the vaccinated, and particularly the well

* "Mr. Cross mentions that he met with several who were supposed to have had smallpox formerly, yet notwithstanding took it on this occasion; but he does not state whether such cases are included in the above summary."

vaccinated, were for the most part very lightly marked, the cases being quite exceptional in which there was anything approaching to disfigurement; but of the unvaccinated a very large proportion were seriously marked and disfigured. Many of them were really hideous to look at, and in several the smallpox had left permanent blindness or deafness."

36. But a tolerably correct comparison of the frequency of smallpox before and since the general introduction of vaccination may be arrived at by another method. The patients admitted to the Smallpox Hospital during eight years (1844 to 1851) were 3,418; of whom 2,071 were vaccinated, 1,347 unvaccinated. Last year the total number treated at the same institution was 1,284; of whom 962 were vaccinated, 322 not so. At the Hampstead Hospital, of 800 cases admitted from December 1st, 1870, to February 18th, 1871, 591 were post-vaccinal, 209 unvaccinated. These three sums present a total of 5,502 cases, 65·8 per cent. vaccinated, and 34·2 per cent. unvaccinated; in round terms, about two vaccinated to one unvaccinated. And this is probably the proportion in which, at the present day, the two classes of cases occur in the general community. But, if the figures most unfavourable to the case are taken, it appears that at no institution are there found as many as three vaccinated to one unvaccinated among the smallpox patients. Yet even these extreme proportions may be allowed to stand here. Now, in the eighteenth century, at least 3,000 per 1,000,000 living of the population are calculated to have died yearly of smallpox; and, as the death-rate was at least twenty-five per cent. (one in four) of the persons attacked, the numbers ill in one year with natural variola (neglecting for the present the inoculated cases) were on the average ($3,000 \times 4$) 12,000 in every 1,000,000 of the population. Of late years, 300 per 1,000,000 living is rather above the annual average of deaths from smallpox; deaths which must be distributed among

the classes of vaccinated and unvaccinated. The proportion of deaths amongst the former is ordinarily five per cent.; amongst the latter, twenty-five per cent. Also of every 100 persons now attacked, probably (as above allowed) seventy-five are vaccinated, and twenty-five unvaccinated. A computation from these figures will show that 300 deaths represent 3,000 persons attacked with smallpox, 2,100 vaccinated and 750 unvaccinated. Of 2,100 vaccinated 113 (five per cent.) die; of 750 unvaccinated 187 (twenty-five per cent.) are fatal cases. The totals represent 3,000 cases and 300 deaths. Hence, it may be *roughly* computed that there are now, *at the most*, 3,000 cases of smallpox, where formerly 12,000, *at the least*, suffered. Besides, to these latter were added, at the end of the last century, the cases of inoculated variola (thousands in number) themselves lightly affected, but forming foci for the spread of the natural disease.

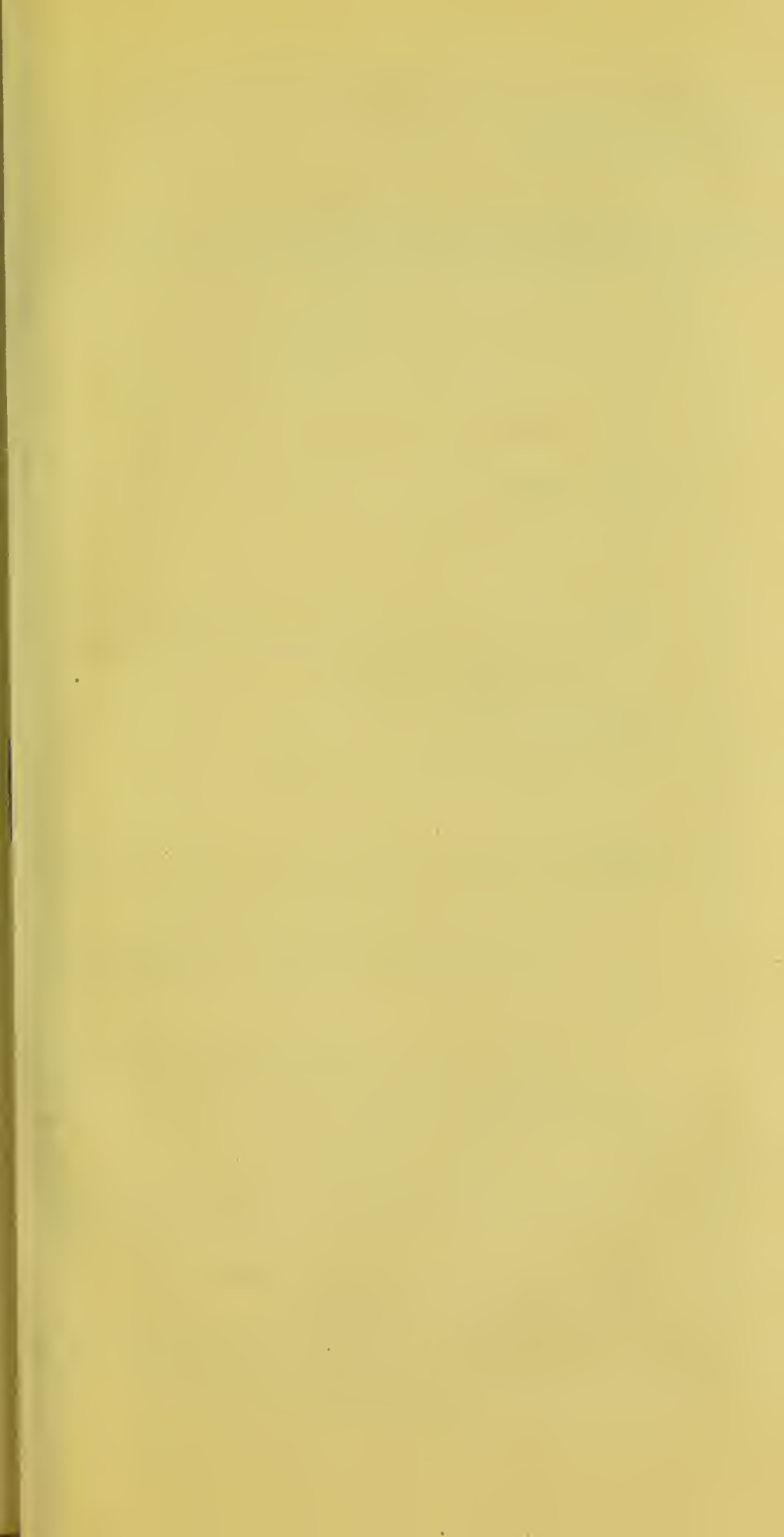
37. It further appears that thorough vaccination “protects” neither more nor less from smallpox than does a “previous attack” of smallpox itself. Could more than this be reasonably expected? Statistics are wanting in this country to declare the exact proportion of the population which has been vaccinated on the one hand and variolated on the other. The great majority certainly belongs to the former class; hence the reason why patients, nominally vaccinated, and admitted into hospitals whilst suffering from smallpox, are so many more than the patients found in the same institutions who are stated to have had a former attack of variola. There are, however, as regards one limited class of the population, some very precise facts. “The records of the Royal Military Asylum at Chelsea show that of 5,774 boys admitted into that institution in the course of the forty-eight years ending December, 1851, of whom 1,950 had, on admission, marks of smallpox, and 3,824 either had marks of vaccination,

or were, on admission, vaccinated, 6·15 per 1,000 of the former, and 7·06 per 1,000 of the latter contracted smallpox subsequently during their residence in the asylum." (*Seaton.*) An inquiry conducted by the Epidemiological Society some years since, showed that 3·5 per cent. of 57 medical men possessing three or more good vaccine cicatrices had contracted smallpox; whilst 3·6 per cent. of 86 who had had smallpox suffered a second time from the disease.

38. But vaccination, if it does not always thoroughly protect from smallpox, is yet found to mitigate greatly the severity of the disease in those so unfortunate as to contract it. The experience of every physician, in every epidemic, furnishes conclusive evidence of the truth of this position. These *post-vaccinal cases form the large majority of instances of mitigated smallpox*, the mildness of which has been already (section 18) contrasted with the severity of the natural disease. For such patients vaccination may be likened to a waterproof coat in a storm; it has not prevented smallpox, but has warded off the more serious effects of all kinds. The percentage of deaths in cases attacked is much lessened; the average duration of illness in those who recover is shortened from about thirty-five to twenty-four days; and injuries of all kinds which the disease inflicts are diminished in number and severity. Thus, post-variolar blindness and deafness have become rarities; and it is not the least of the merits of vaccination that faces pitted with smallpox no longer meet one at every turn. And here steps in a curious fact: the vaccinated of the same age are found to be protected from smallpox precisely in the proportion in which the *number and quality* of the cicatrices upon their arms show them to have been thoroughly vaccinated. This is well brought out in the following statistics (none the less striking because oft-quoted) of 6,000 cases observed at the Smallpox Hospital during twenty-five years:—

Cases of Smallpox classified according to the vaccination marks or cicatrices borne by each patient respectively.		Number of deaths per cent. in each class respectively.
I. Unvaccinated		37·
6,000 Cases.	II. Stated to have been vaccinated, } but having NO cicatrix	23·57
	III. Vaccinated :—	
	(a.) Having ONE vaccine cicatrix	7·73
	(b.) Having TWO vaccine cicatrices	4·70
	(c.) Having THREE vaccine cicatrices	1·95
	(d.) Having FOUR or MORE cicatrices	0·55
IV. Having previously had smallpox...		19·

The general mortality at the same hospital of the unvaccinated, and of those who have previously had smallpox, is added, that the contrast may be the more striking. But besides the number, the quality of the cicatrices greatly influences the result. Thus, in the above table, among cases (class *a*) in which the one cicatrix was *well* marked, the death-rate per cent. was 3·83; among cases in which it was *badly* marked the death-rate was 11·91. Among cases (class *b*) in which the two cicatrices were *well* marked the death-rate was 2·32; among cases in which they were *badly* marked it was 8·34. *It is, therefore, not only necessary for a person to have been vaccinated, he must have been WELL vaccinated, and have had his constitution thoroughly affected by the cowpox, in order to be efficiently protected.*



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39. Now, in smallpox statistics, every one who can show the faintest mark on the arm is classified as "vaccinated." Frequently this is very unjust, tending (as it does) to bring vaccination into undeserved discredit as a preventive. With more propriety patients might often be described as "nominally vaccinated," so faint are the traces of the successful performance of the operation.

40. But, some one will remark, when does vaccination protect any one? From the moment when the contagium is inserted into the arm? Certainly not. After the seventh day it seems to exercise some modifying effect upon smallpox, and after that the protection increases daily, and the modifying effect becomes greater, until when the areola forms around the vaccine vesicle and the constitutional symptoms occur (ninth or tenth day in primary vaccination, sixth or seventh in re-vaccination) the system is perfectly proof against the manifestation of the major disease. If the description of smallpox (section 8) be turned to, it will be noticed that the first serious symptoms of illness do not show themselves until eleven times twenty-four hours have elapsed from the date of infection. Let it be supposed, now, that a member (A) of a household, having taken smallpox, becomes ill (on Monday, the 12th of the month, say) at midday. It is possible, though denied by some, that his breath may even then be infectious. Let the supposition be granted, and let it be further assumed that in the next two days all the other inmates (represented by B) are infected from A. At the earliest, the severe symptoms with B will begin, then, on the following Friday week (the 23rd of the month) at noon, that is, after eleven completed days. Although A feels very ill on Monday (the 12th), the rash does not appear upon him until Wednesday (the 14th), and the medical man, then summoned, will generally be able at once to recognize the complaint. If, then, B, and the other inmates upon whom the

variolaous poison may have passed, be at once (*i.e.* on Wednesday, the 14th) carefully vaccinated, the cow-pox will overtake in them the smallpox process, the manifestation of which it may almost certainly be trusted to prevent. For, even if any of them are primary vaccinations, the areola will be forming around the vesicles on Wednesday (the 21st), a sign that the disease is fast becoming constitutional; whilst the systems of any previously vaccinated will be yet sooner influenced. Some observations, published by Heim of Wurtemberg, and Hérard, would show that smallpox eruption has been known to occur as late as the fifteenth day after the performance of a successful vaccination; which means, in other words, that the premonitory symptoms may come on the thirteenth day. But these cases are extremely rare; and, ordinarily, it may be asserted that, if a person passes the ninth day after a successful vaccination without a symptom of variola, he is almost to a certainty protected therefrom by the vaccination.

41. A child, aged three months, vaccinated on a Monday, began to be ill with smallpox on the following Friday, and died of the disease on the Sunday week (14th day after vaccination), its illness, apparently, being quite unmodified by the vaccination, which "took," but in a modified form, as is the case whenever smallpox has been latent in the system for four or more days before the performance of vaccination. Had the operation in this case been performed four days sooner, smallpox would have been robbed of one of its victims. Again;—a woman began to suffer from smallpox, and all her children, being at once vaccinated, escaped. Her husband at first ridiculed the idea, but after about a week, consented to be vaccinated. In five or six days, however, he began to suffer with smallpox. The disease in him was certainly mitigated by the vaccination, although not quite prevented; and had he sooner followed the advice of

his surgeon he would have escaped variola altogether. Mr. Marson, whose thirty-five years' experience at the Smallpox Hospital, renders him a great authority, has, since the above was written, kindly directed the author's attention to the following passage in one of his writings, in which he is very precise upon this question. He says:—"Suppose an unvaccinated person to inhale the germ of variola on a Monday; if he be vaccinated as late as on the following Wednesday, the vaccination will be in time to prevent smallpox being developed; if it be put off until Thursday, the smallpox will appear, but will be modified; if the vaccination be delayed until Friday, it will be of no use, it will not have had time to reach the stage of areola, the index of safety, before the illness of smallpox begins: this I have seen over and over again, and know it to be the exact state of the question. Re-vaccination will have effect if performed two days later than primary vaccination, because in re-vaccinated cases the stage of areola is attained two or three days sooner than in those persons vaccinated for the first time." He concludes by remarking that it all "shows the necessity of performing the vaccination as promptly as possible in houses where smallpox exists."

42. When the smallpox process has advanced to the stage of primary fever, that is, when the sufferer first begins to feel ill with nausea, shivering, &c., it is doubtful if vaccination can serve any useful purpose, the smallpox has so much the start in point of time.

43. Another query presents itself. How long does the defence against variola given by successful vaccination last? For life; or does it decrease year by year? Jenner himself believed and maintained that protection once given remained *in every case* undiminished until death. Evidently time was required to test this opinion thoroughly, and that was an element of which he had but a limited supply, for he died in 1823.

This is the only flaw that subsequent observers have discovered in his doctrines—a fact which, considering the world-wide application his principles have had, often in the presence of most sturdy opponents anxious to detect the slightest error, attests clearly the painstaking care he used for the verification of each statement he advanced.

44. It seems pretty clearly proven, however, that the protection afforded by infantile vaccination does *in some instances* tend to wear out. And certain facts observed at the Hampstead Hospital confirm this opinion. Dr. Grieve states that of 591 nominally vaccinated cases admitted during the present epidemic with smallpox, “the rate of mortality under ten years of age was 9·8 per cent.; from ten to twenty years of age, 2·8; from twenty to forty, 12·6 per cent.; over forty, 22 per cent. Of those under ten years of age there was no doubt that complications carried off a large number.” [In the unvaccinated at this early age the death-rate is often 50 per cent. of those attacked.] With “this allowance, the figures show that the rate of mortality increases in a marked degree after twenty years of age.” Very similar results were tabulated at the Highgate Hospital concerning 3,094 vaccinated persons admitted with smallpox between 1836 and 1851. So that infantile vaccination defends up to about the age of puberty, and protection should be then renewed. It may be urged that the deaths from natural smallpox, where there has been no vaccination, follow a somewhat analogous scale. This is true, but the difference in the death-rate before, and after, twenty is not in that case so marked as with the disease modified by vaccinia. Again, it is said that those who die are the people with broken constitutions, who have led irregular dissolute lives; dramdrinkers, to whom almost any complaint is a serious affair. Quite true; but as smallpox is to them so fatal, that is all the

more reason why they should be protected from its ravages.

45. Thus, renewed vaccination is required to shield those who were imperfectly vaccinated in infancy, and because it is found in certain cases that the protection given by primary cowpox diminishes with lapse of years, lasting usually until about the age of puberty. And, as it is uncertain in any single instance whether the susceptibility to smallpox has recurred, re-vaccination should be carefully performed (once, at any rate) upon every grown-up individual. In fact, it would be well if the legislature rendered it compulsory upon every one between sixteen and twenty-one years of age. And it should not be deferred until times of panic; because the applications for re-vaccination are then more than can be carefully attended to.

46. *The immunity against variola afforded by one good re-vaccination, which "takes" thoroughly, is almost absolute.* During thirty-five years no nurse at the Highgate Smallpox Hospital has contracted smallpox, simply because all are re-vaccinated before entering upon their duties. Similarly protected, each member of the staff employed at the Hampstead Hospital has passed scatheless through the present severe epidemic. In thirty-five years at the Highgate Hospital there have been in all only two or three deaths of persons believed to have been re-vaccinated: and in them the marks of the operation were not good.

47. But other points remain for discussion. One re-vaccination being so desirable, is it necessary, in order to make assurance doubly sure, to repeat the process after a period of years? There are those who believe that one good re-vaccination is enough; others advise a repetition every ten years; others even urge that it be done every seven years. Indeed, medical opinions respecting the expediency of multiple re-vaccinations are, perhaps, more at variance than those concerning any other question of vaccination. To

hear the light way in which repetitions of the operation are sometimes recommended, one would almost imagine the process to be rather pleasant than otherwise. Whereas, at a time of panic, when variola is on the increase, and crowds are rushing to be vaccinated, it is clearly the province of the physician to calm the excitement, to allay unnecessary fears, and not vaccinate all who may indiscriminately apply to him. He should make a selection, operate upon those he deems unprotected and in good health, even urging the desirability of the proceeding upon all who, though undefended from smallpox, are yet unwilling to undergo vaccination; but it is equally his duty to counsel those who appear secure from variola that re-vaccination in their case is needless. The conflict of opinion upon this question of renewed re-vaccinations renders necessary a brief consideration of the subject.

48. Now, the end in view is protection, perfect protection against variola; all short of that point is insufficient, as all beyond it is superfluous. Therefore, every one who is still susceptible of smallpox should be vaccinated; but those who are quite protected need not the operation. Consequently, it becomes necessary to determine who *are*, and who are *not*, protected. The only known defence against smallpox is afforded by a "previous attack" of the disorder in one of its forms; and vaccination gives such immunity simply because it is modified variola. And here one is met by a circumstance certainly opposed to preconceived opinions. Most men would imagine that all attacks, light or severe, of a constitutional disease would produce equal immunity from further assaults of the same. Such opinion, however, is not in consonance with observed facts. If the "previous attack" be light, there is imperfect protection from the first, which with length of years becomes even more enfeebled; but with a severe "previous attack" the immunity is almost absolute for the rest of life. And this rule applies equally to both smallpox and vaccinia.

49. Two points must, therefore, be known, in order to judge of the amount of protection enjoyed by any individual: the *severity* of, and *time elapsed* since, his "previous attack. As regards the "*time elapsed*," the person himself usually affords the information required; but as regards the *severity of the previous attack*, the physician judges for himself by an inspection of the traces left by the disorder. If the "previous attack" was one of smallpox, the present state of the face usually witnesses to its mildness or gravity; whilst, if the protection was given by cowpox, the resultant markings on the arm are scrutinized for the same purpose. Not that the scars themselves afford protection, they merely indicate whether the disease was true vaccinia,* mild or severe, and, therefore, to what degree, protective. Theoretically, then, protection is proportionate to the number and good quality of the scars, and to the recency of their production.

50. But certain circumstances disturb the mathematical precision of this rule, when universally applied in practice. If all constitutions were equally prone to smallpox, and all could be with unvarying facility vaccinated, it would be an easy matter to draw a hard and fast line dividing the protected from the unprotected against variola. But among unvaccinated persons there seems to be very unequal liability to contract smallpox upon exposure to infection; and, therefore, it is easy to understand that the imperfectly vaccinated are not all equally susceptible thereto. Nor with any single individual does the proneness to smallpox seem at all times identical. Probably, too, a person may occasionally be proof against a slight

* The marks left by the best vaccination are distinct, pitted, dotted, and having a well-defined edge. Indifferent vaccination leaves marks which are indistinct, smooth, without dots, and have an irregular and ill-defined edge.—*Marson*.

whiff of contagium, and yet capable of having smallpox upon exposure to a less diluted dose of the poison. Further, one child in about one hundred and fifty is usually found to be incapable of undergoing the vaccine process. All these are personal peculiarities, that are clearly outside all rules—they are anomalies, and must be regarded as such.

51. Again, it seems certain that many people are susceptible of vaccination (at any rate, of modified cowpox), a definite quantity of the *undiluted* poison of which is brought into contact with a raw surface in the skin, who yet would be proof against smallpox contagium *scattered* far and wide through the air, and settling upon the unwounded lining membrane of the respiratory tract. In other words, individuals may, perhaps, be vaccinated, and produce even an apparently typical vesicle, when they would not contract variola by any amount of exposure to a smallpox-infected atmosphere. This opinion is opposed to the conviction common amongst physicians, and it is, perhaps, safer in practice to act upon the idea, that the person who can undergo a modified vaccination was previously unprotected. Still, in the present epidemic, it has been notorious that persons who have had cowpox in infancy and severe smallpox after puberty, have yet “taken” comparatively well upon being re-vaccinated; nevertheless, all statistics prove that a very small percentage of people so circumstanced ever contract smallpox. On the other hand, the existence of good vaccinal scars does not infallibly demonstrate that the possessor is “protected;” for a child may catch fatal variola within two or three years of a vaccination that seemed to be perfect, and left first-class scars, though this is an extremely rare occurrence. But, upon encountering these cases, one must recollect how very varying are the peculiarities incidental to the multitudes of different constitutions which are vaccinated, and then ask if it is matter of

surprise that occasionally success fails to follow the operation? It follows also, as a corollary from the above remarks, that the manner in which a person is affected by re-vaccination cannot be held to show conclusively the degree of liability of such person to smallpox. If the arm "takes" well, it does not prove that smallpox would necessarily have been contracted upon exposure to the "contagium;" and it is a most hazardous opinion to entertain that, because a person does not "take" vaccination, therefore he is fully protected from smallpox. (See further, section 56.) Hence it is impossible to define exactly the boundaries between those liable and non-labile to variola; still a very close approximation to the truth can be attained, and rules may be framed which nought but the want of thorough knowledge prevents from being perfect.

52. Experience, then, has already taught that a severe attack of smallpox or vaccinia in infancy or early childhood "protects," at any rate, for about the following fifteen or eighteen years, and in many cases for the whole of lifetime. And one re-vaccination at the end of those first fifteen or eighteen years which "takes" well, or in its stead an attack of smallpox—although either may be modified in its course—is almost certain to "protect" for life. And usually the re-vaccination, except in cases of necessity, should not be performed before this age of fifteen or eighteen years, in order that its resultant "protection" may the more certainly endure until old age. Two occurrences of the fever-process, whether attacks of smallpox or vaccinations, or an attack of each in either sequence, seem to give *almost* absolute security, and render unnecessary a repetition of vaccination, except under such exceptional circumstances as an extensive prevalence of smallpox.

53. It must be further remembered, in connection with this same topic, that the most fatal period of

smallpox is during the first years of life. Half of the unvaccinated under five years of age who catch the disease die; the death-rate is still higher in those below two years; and a fourth of all the deaths from smallpox in England happens to infants less than twelve months old. Again, the vaccine process is liable to be interfered with, and have its protective influence diminished, if it occurs during teething; hence the necessity for vaccinating soon after birth, before the child can contract smallpox or is about its teething. From the sixth to the eighth week seems generally a good time, because subsequently the child becomes vigorous, and in the flourish of its arms is liable to rub the vaccine vesicle. But if the child is at all ailing, the vaccination is to be deferred.

54. The practical conclusions that may be drawn from the foregoing remarks are, that *every child, unless ill health contra-indicates the operation, should be thoroughly vaccinated (before it is three months old, says the Legislature, with the approval of science); and that every adult should be carefully re-vaccinated between the age of fifteen and twenty-one years.* As a rule, *further vaccination seems unnecessary*; but the actual presence of smallpox in a house, or in the immediate vicinity, may render expedient precautions which generally would be quite uncalled for. In that case, every child, of whatever age, who has not three or four very good vaccinal scars, should be again operated upon; and all adults who were re-vaccinated, or had smallpox more than ten years before, should also, perhaps, have their protection renewed. But it must be distinctly understood that these are "panic measures," and not necessary, except when great risk renders them desirable.

55. A circular recently issued by the Medical Department of the Privy Council Office, states that, "re-vaccination, once properly and successfully performed, does not appear ever to require repetition."

These views differ from those enunciated by many medical men; but they are not unadvisedly advanced, since they have the sanction of all truthful records of smallpox, which (section 47) show how rare is the disease in those who have already twice undergone the fever-process.

56. But, some one will remark, "I was lately operated upon, and did not 'take;' does this indicate that I am 'protected'?" Now, a successful vaccination depends essentially upon three items: the capability of the system to be affected by vaccine virus, the goodness (in all particulars) of the lymph employed, and care upon the part of the operator to produce actual contact of such lymph with the freshly-made scratch or puncture. As was above stated, only about five per cent. of re-vaccinations should fail to "take." If, therefore, a much larger proportion is unaffected by the operation, no vacciniiform action whatever showing itself at the point of puncture, it may be pretty safely affirmed that the fault rests with the operator or the lymph. If one in twenty only shows no sign of "taking," and the other nineteen (as in a school or family) are affected, the conclusion is justified that such twentieth person is proof against cowpox, and therefore, presumably, against smallpox. Nevertheless, *it is well for such an one, and for all who have not "taken" at all upon re-vaccination, to submit themselves once again to the operation.* M. Perroud even suggests that the operator should go on re-vaccinating in these cases until proper vesicles are produced. The following case is, at any rate, encouraging. A child, aged three years, was at intervals vaccinated without success four times by different operators; at a fifth vaccination, three months only after the fourth, the arm "took" well. An entirely unsuccessful performance of vaccination changes in no respect the condition of a person; and therefore, if vaccination or re-vaccination was deemed

to be necessary before the operation, it is still equally to be desired. A surgeon lately related the following : "All the members of two large households in the west of London were vaccinated in February last, and all 'took' except one servant in each family. In neither of these did any vaccinal action occur in the arm, and neither was again vaccinated. Smallpox has since picked out each of these two servants ; one died, and the other was convalescing" when the facts were mentioned.

57. When all the members of a family are re-vaccinated at one sitting by the same operator, with lymph from the same source, it will be found that they show various effects. In some, perfect vesicles arise ; in others, the arm becomes swollen, and serum is discharged from the vesicles in great quantities ; in a few the effect at the site of puncture is quite abortive, the pimple, at first formed, after the fourth or fifth day shrivelling away. Should these last-named be again vaccinated ? Probably not. They are in a different category to those who do not "take" at all, inasmuch as some vaccinal action has shown itself ; in fact, it is probable that they were already considerably protected, and have been affected as much as their system was capable of being impressed with the lymph, for others have "taken" well with the same virus and the same operator. But if they are much exposed to smallpox infection, they should certainly submit again to the operation.

58. It is not known if it is an absolute rule that "all who are capable of taking smallpox can be successfully vaccinated." Probably it *is* a rule without exceptions. Variola, as above stated, does occasionally happen to individuals only a few weeks after an altogether unsuccessful attempt at vaccination ; but, in cases of this sort, one cannot be sure whether the patient, the operator, or the lymph, was the cause of failure. Nevertheless, such occurrences must give

the operator a vivid impression of the great responsibility under which he labours, not to let those he vaccinates rest in fancied but false security from smallpox, and, so minded, encounter hazards that they would otherwise certainly shun.

59. And now one comes to examine in detail the OBJECTIONS urged against vaccination. Unfortunately, the controversy being sharp, the passions and prejudices of the multitude have been appealed to, and abusive epithets freely used; and much of mere unproven one-sided statement, based upon no well-ascertained facts, and often varying widely from the truth, has too frequently taken the place of solid argument and gained a spurious victory, when calm reasoning from well-observed phenomena should alone have decided the day. "Whispering tongues can poison truth!" For example, vaccination is called a filthy process; but can any one who says that have ever seen a case of natural smallpox, and not considered how it is infinitely more loathsome? Facts have even been so radically misrepresented as not rarely to enlist that purest of all human affections, parental love, upon the side opposed to Jenner's doctrines; whereas, unbiassed consideration of all points of the question must produce the conviction that the child's preservation from death by smallpox hangs tremblingly in the balance unless it be vaccinated. A perusal of the Blue-Book containing evidence lately given before the Vaccination Committee of the House of Commons by the most prominent anti-vaccinationists, will demonstrate the justice of this general criticism of their objections.

60. But what thought Jenner's contemporaries of his discovery? How did they estimate it? Evidently, to them it seemed anything but a myth, for Parliament granted him the sum of £10,000 in 1802, and £20,000 in 1807. And men of the highest station

in all countries throughout the civilized world hastened to bestow upon Jenner the highest possible honours for his great discovery. People of different nations became frantic with joy when vaccine lymph was first brought to them for their use. And the judgment of that day was doubtless correct; for the world then knew full well the terrible character of its chief pest.

61. One cardinal point overlooked now by objectors is the terrible nature of smallpox itself, when unchecked by vaccination. The present generation knows nothing of it. In the epidemic now (1871) raging, the mortality from variola in London for twenty weeks has averaged 230 weekly,—a higher death-rate from that cause than has occurred in the previous fifty years,—so that in less than a fortnight as many victims have fallen as in other times a whole year has produced. And were this sad ratio to continue during twelve months, the lives thereby lost in the metropolis (with its 3,250,000 inhabitants) would be about 11,960; that is, 3,680 per 1,000,000 living persons. Yet that sum, occurring during this the worst pestilence for fifty years, exceeds by very little the *lowest* average of mortality from smallpox in those years of the eighteenth century which were remarkable for freedom from the disease; whilst at times, in the pre-vaccinal days, when the pest was more than usually severe, it quite decimated the land, so that it is scarcely possible at the present day to realize in thought the horrors attendant upon smallpox before Jenner's time. And great as the horrors of variola then were, it was generally possible to localize considerably an outbreak of the disease; but now, with extended railway and steamboat communications, its spread would be still more frightful, were it to go unchecked by vaccination. And in spite of wishes to the contrary, it is always present, to rob the nations of their strongest and their best; and its still further prevalence is checked by vaccination

alone. If these facts be kept prominently in view, the triviality of many of the criticisms hurled against vaccination will at once appear.

62. All the objections may apparently be ranged under two heads: those directed against the practice itself, upon the grounds that vaccination is useless and injurious—and those raised against the law that renders compulsory the vaccination of children within three months from birth. The uselessness of the practice is urged, because “in certain instances persons vaccinated have variola.” Quite true, and unreservedly admitted (as in the foregoing pages) by every one. Nay, it is even granted that each case of the kind does, so far, detract from the perfect realization of the hopes which physicians have entertained of being able to completely eradicate smallpox. But is vaccination on this account any less a protection to each of the members of that other far more numerous class to whom it has afforded complete immunity from a most fell disease? They, and they have probably been millions during the last seventy years, have, at any rate, no reason to complain of the process which has been their safeguard. Besides, of the cases relied upon, as examples, by opponents, when they have the hardihood to state that vaccination does not prevent smallpox, the majority are those who really are not sufficiently vaccinated. Moreover, one attack of smallpox itself does not always prevent a recurrence of the malady.

63. Secondly, vaccination is declared useless, because, “although its practice is extended to almost the whole community, the mortality from smallpox is still very high.” Unfortunately, this is the case. And the way out of the difficulty has been shown to lie, not in the rejection of vaccination, but in the perfect performance of the operation in infancy, and in its universal repetition at adolescence. It is to be feared that the present high rate of mortality is partly the

result of an agitation which grew to a head two or three years since, so that many parents were then induced to evade the law. And it may be laid down as an irrefragable canon, that "defective vaccination always permits sooner or later an increased prevalence of smallpox."

64. A third objection of the anti-vaccinationists is thus stated. "The ratio of vaccinated cases to the whole admissions (at the Smallpox Hospital) stands as follows:—

In 1851—52	...	...	66·7	per cent. vaccinated.
1854—56	...	...	71·2	" "
1859—60	...	...	78·0	" "
1863—66	...	...	81·1	" "
1867	...	..	84·1	" "

In each succeeding epidemic, therefore, the number of vaccinated persons who have to be taken to the Smallpox Hospital is greater than in the preceding one. How any one can, in the face of these facts, published by the friends of vaccination, believe in Jenner's theory, is a mystery." The writer of the pamphlet from whose pages this quotation has been taken neglects to state that before 1853 infantile vaccination was not obligatory, and that since then the law has been yearly more strictly enforced. And, of course, as vaccination becomes more general, fewer people remain unvaccinated, and there is necessarily in each succeeding epidemic a smaller proportion of them to be attacked. But to take the highest numbers, those for 1867, is it probable that only 84·1 per cent. of the general population were vaccinated? was not the number much more, probably 94·1 per cent. at the least of those living? If so, why were not the admissions 94·1, instead of 84·1 per cent.? Clearly, upon such supposition, vaccination had lessened the number of admissions to the hospital.

65. But among those attacked, the mortality is

ordinarily 30 in 100 unvaccinated cases, to only five in the same number of the vaccinated. Is this fact to remain unnoticed? Hear what the writer of the above-cited paragraph remarks:—"It is sometimes objected that if the vaccinated do take smallpox, they have it in a milder form. Well, they die of it. I don't know whether you call that a mild form of disease which terminates fatally; for my own part, I don't. But this position really gives up the whole theory of Jenner, which you will remember was, that the vaccinated were protected thoroughly against the ravages of smallpox. He said nothing about milder forms of the malady; that was the old doctrine of inoculation, and totally foreign to the principle of vaccination, and is only now resorted to as a subterfuge by those who don't know how to get out of the difficulty in which numerous facts place their theory. But I may remark, this this is not the case, that—*cæteris paribus*—the vaccinated and the unvaccinated alike suffer and alike die." To which mere unsupported statement all the statistics obtainable, in all parts of the world, from perfectly authentic public sources, are flatly opposed.

66. It will be noticed, too, that in the quotation just given the real question at issue is not fully and fairly met by plain straightforward argument and appeal to known facts—for facts here stubbornly refuse their assistance to the opponents of vaccination—but a topic of secondary importance is brought to the front, that the debated point, the reply to which would be inconvenient, may be befogged and shirked. Is this, however, to say the least, fair play before a general audience,* knowing not the important interests—no less than the lives of millions—concerned in the question, but seeking for enlightenment from those who

* The essay, from which the above paragraphs are cited, was delivered, not three years ago, as a lecture in the Temperance Hall, Sheffield.

assume to themselves to guide opinion? For, be it observed, the point is not—what did Jenner teach? but—is vaccination of use, or not?

67. Medicine, it must be remembered, is a progressive science; and medicine, righteously pursuing her pathway of discovery, owns no masters, is careful overmuch for no mere theories. Truth is her sole great aim, before which all else must retire. In this pursuit she collects and hands down the scientific teachings of her many patient labourers, which are thenceforward tested, some more, some less, as fit occasions arise. Probably no other medical doctrine has ever been so severely and frequently tried under all conditions as this of Jenner. And, as the result of the ordeal through which it has gone, the almost unanimous verdict passed upon it by the members of the medical profession throughout the world, *i.e.* of those who have grounds for a calm, candid judgment, unswayed by prejudice—is, that, on the whole, vaccination is an incalculable boon, which has already saved its millions of lives, and prevented disfigurement and misery, and that its few drawbacks are as nothing when weighed against its advantages.

68. But, further, it is no real reproach that the scientific views concerning vaccinia now entertained are not quite the same as Jenner held, and that revaccination is now known to be required for all adults. The matter could not rest where Jenner left it. Nor did the applications of steam to mechanism cease to advance when Watt died. Experience alone demonstrates the merits and the failings of all discoveries. The successors of Jenner began their observations, possessed already of the knowledge to which he had at his death attained; and the result is, that insight into the subject is since his day far advanced, so that men now know better what may be expected of vaccination, what it *can* achieve, and what it *cannot* perform.

69. Fifthly, it is stated that "vaccination has degenerated by repeated transmission through the human body, and is consequently less protective now than formerly." But the appearance of good vesicles in the present day, the produce of lymph which has probably come in a direct line of succession from that used by Jenner himself, is identical with the description given of them by Jenner in the first year of vaccination; the subsequent scars are, now as then, the same in all respects; and the protection against smallpox secured by thorough vaccination is as perfect in 1870 as it was in 1800. If sufficient care be not exercised by the surgeon in his choice of lymph, and he should fail to take it upon the proper day, he will at once arrive at a vaccination which is weak and unprotective. Only in this sense does lymph degenerate. And the skilled inspectors recently appointed to pay periodical visits to the vaccine stations, upon recognizing such degeneration can, and will, at once rectify it by changing for more active virus the lymph-stock of any public vaccinator in which they have not perfect confidence. But a gardener would not dream of choosing seed from poor plants, or when the seed is unripe; and if he found his plants defective, he would elsewhere seek seed for future crops. So the surgeon chooses his lymph from good reliable sources; and, in doing so, it would seem that his expectation that it will continue unimpaired by time is as reasonable as that of the agriculturist who when he has sown wheat looks for a crop of the same, and plants his acorn in perfect trust that future years will give him an oak. Again, to cite parallel cases,—does smallpox degenerate? does scarlet-fever or measles grow weak by lapse of time? Alas! no; would that they did! But their immutability under very varying conditions forbids one to expect that, with the exercise of care in the choice of lymph, vaccinia will change with years. Still, it is reassuring to know that Dr. Seaton,

who, being the Government Inspector, has enjoyed singular opportunities for observing vaccination as practised in all parts of England, states that he "has never seen anything to warrant the notion that the general lymph-supply of the country has undergone any necessary deterioration."

70. But vaccination is also opposed because it is said to be *injurious*; the producer, as well as conveyer from child to child, of numberless maladies. Now, no statement, unless supported by substantial evidence, can, at this stage of the inquiry, be entertained for discussion; because it were a mere waste of time to endeavour to refute the many random conjectures that have been published. Mere idle guesses most of them, with ne'er a figment of existence but in the imagination run riot of their authors. By foes to vaccination, every ill that happens in childhood, for the few weeks succeeding the operation, is regarded as its effect. The "post hoc" is made a "propter hoc." For example, the itch, dependent upon the presence of a minute spiderlike creature in the skin, often appears in the out-patients' rooms of hospitals and dispensaries, alleged to be a result of vaccination! "Ex uno disce omnes." As well might one occupy time in attempts to upset the opinion that witches have power to produce the cattle-disease, or that "Tenterden steeple is the cause of the Goodwin Sands."

71. Still, all that is advanced in a spirit of anxious search for truth, whether it tell for or against his position, claims from the student of nature a patient and laborious investigation. And imbued with this spirit, one must here enter the lists.

72. Two causes are assigned for the development of the maladies which vaccination is said to produce. It is alleged that sometimes these ailments arise *de novo*, simply as the result of the operation itself upon the system; and that at other times they are actually

transmitted from one child to another with the vaccine lymph. First, supposing the lymph to be perfectly healthy and quite fresh, does the operation in such case ever cause any disease, local or constitutional, other than cowpox? As regards local affections in the vaccinated arm:—In sickly infants, the small ulcers that arise at the sites of puncture are, in rare instances, some days in healing; more uncommonly still, an abscess forms in the arm or adjacent armpit, and an attack of erysipelas, commencing in the arm, is not unknown. Also that most rare and sad event, death after vaccination, seems, when it has occurred, to have usually originated in one, generally the latter, of these affections. These are, however, the only local ailments chargeable to vaccination; and all of them are so very rare, that the operator who has vaccinated thousands of children scarcely ever witnesses such untoward occurrences.

73. But one cannot pass unchallenged the gravest of all charges which vaccination has to answer—that death has followed the operation. The Registrar-General of Scotland states that, “in 1868 there were vaccinated in Scotland 106,181 children, and of that number two were recorded to have died from the consequences thereof; that is, one death in 53,090 cases.” He further remarks, “Now, the constitutions of some children are such that the slightest scratch or abrasion of the skin is followed by inflammation and death. Need it be wondered at that two deaths should occur from that cause among the 106,181 children whose arms had been scratched to insert the vaccine virus? The astonishment is, not that there were deaths, but that the deaths were so few.” But when death has occurred, it has probably never been from vaccination, pure and simple, in a thoroughly healthy subject. It is impossible to imagine that a child, so ill as to die from the operation alone, would ever be vaccinated by any surgeon; and it certainly requires equal imagina-

tion to suppose that lymph which any surgeon would use could ever of itself cause death in a healthy infant ; consequently, in giving a reasonable explanation of these sad cases, one is constrained to admit one of two remaining suppositions. Either the child fell ill with another disease when the vaccinia was in progress (in which case the death could not be admitted as a death from vaccination simply), or the vaccine vesicles were poisoned, as any other wound might be, after the operation. For example, in a death known to the author that occurred in the practice of an experienced vaccinator, the child shortly after the operation lost a large quantity of blood from a cut on its finger, and was thereby greatly weakened ; the punctures in the arm were then probably poisoned by matter, "pus," that was coming from an abscess seated in the finger of its mother, and produced by the prick of a fish-bone. For the vaccination-scratches took on the very same action as the mother's abscess ; erysipelas supervened, and, spreading, killed the child. This was registered as a death from vaccinia ! But do the facts of the case justify such an assumption ? And if the other few mishaps of the kind were carefully examined, it would probably be always found that death occurred from some other cause, just when, unfortunately, the child had been vaccinated ; or from the combination of cowpox and another disease. These mischances, therefore, need not in the least cause one to consider vaccination anything but a harmless procedure ; they only show that, when cowpox is in progress in an infant, extra care should be taken to keep it out of the way of other diseases.

74. It will be noticed that all these local ailments are regarded as commencing afresh in the vaccinated infant itself ; and are not said to be imported from the infant furnishing the lymph. Now one must inquire concerning constitutional diseases. Some of

these are alleged to originate in the infant, through the operation bringing it into a low state of health (as one might express it): other diseases of the class (it is urged) are actually transmitted from infant to infant. First, then, *are other constitutional diseases than cowpox ever produced by vaccination when the lymph comes from a perfectly healthy child?* Before the age of three months, when all infants are by law vaccinated, constitutional diseases, with few exceptions, rarely manifest themselves; and, therefore, the appearance of any such malady is almost certain to have been preceded by vaccination. This fact lends an appearance of probability to a parent's statement, when, as often happens, he urges that his child was quite well until it was vaccinated, whereas since then it has always been ailing. Again, no parent is willing to allow that his child suffers from any hereditary complaint—and most constitutional diseases of infancy, at any rate, are of this nature—and therefore, if his child should show symptoms of such a kind after vaccination, the parent finds in that vaccination a very handy excuse for all his child's miseries, and one that seems all-sufficient to ignorant minds. These considerations must not be altogether ignored when parents maintain that cowpox has injured their offspring.

75. Now this, from its very nature, is just one of those statements most difficult to disprove; wherefore the friends of vaccination are the more entitled to demand positive proof of the occurrence, to expect that instances, with date, place, &c., shall be cited, before they can allow the truth of the allegation. And when this is done, it will usually be found how baseless is the statement, that the disease in question (whatever it may be) has been produced by vaccination; for in many of the reputed cases the malady is known to be absolutely uninoculable. Each disease also has its origin in definite condi-

tions; in some cases these are thoroughly known, and if the disease alleged to have been set up be one of them, as is often the case, it can then be at once most certainly stated that vaccination had nothing whatever to do with its causation. Of other diseases, the exact sources are, as yet, less understood; but even in these cases it requires the most fertile of imaginations to perceive the least relation between vaccination and its alleged product, a constitutional malady—and probably future knowledge will dispel ideas of any such connection whatever.

76. For it is a matter of some moment that no disease is now known which did not exist before Jenner's time. And this fact is fortunate in another respect, since it permits the comparison of death-rates of *all* diseases before and since the date of the general introduction of vaccination.

77. Amongst the diseases once said to be produced by vaccination were *fevers, consumption, and scrofula*. At the present day the causes of *fevers* of all kinds, typhus and typhoid, measles, and scarlet fever, are better recognized than formerly; and it is known most certainly that they have nothing at all to do with vaccination. Now, therefore, it is no longer heard that they are its product. As regards *consumption and scrofula*, never has a particle of real proof been brought forward that these evils are increased by vaccination. Indeed, since it has been generally practised, the deaths caused by all the maladies just mentioned have steadily diminished, as is witnessed by the above-cited papers of the Board of Health. "When there are thrown into one group all the deaths of the present day which might have been included under the old application of the word 'fever,' even with this large addition the so-called 'fever' now occasions an annual death-rate of only 385 per 100,000 living, whereas a century ago its death-rate was close on 539. Fever

has progressively subsided since 1771; and the combined mortality of smallpox, measles, and scarlatina is now only half as great as the mortality formerly occasioned by smallpox alone." Similarly, the yearly death-rate from scrofula per 100,000 living, which in 1681-90 was 801, and in 1746-55 was nearly 1,099, is now but 206; so that looking to the middle of the last century, we find a scrofulous death-rate more than five times as great as our present one." "The mortality from diseases of the lungs of the present time is 7 per cent. lower than the pulmonary death-rate of 1746-55; and the proportion of persons destroyed by consumption with other forms of scrofula has progressively declined in London." Moreover, it is probable that the diminution of scrofulous affections in late years has been due to the lessened frequency of variola; for "all writers on smallpox attest the frequency with which scrofulous affections follow in its train." And Mr. Simon further remarks that "in such measure as vaccination is less impoverishing and less depressing than smallpox, in just such measure does its substitution for smallpox act in prevention of scrofula."

78. Again, it is said that, "if smallpox is now less frequent, other eruptive diseases are more common, and, therefore, the world has in reality received no benefit from vaccination." Now, in the complete absence of any returns of sickness only (without resultant death), one is compelled to look to the tables of mortality for reply to such an assertion. Which may be done with perfect propriety, since the *proportional* mortality in the whole number of cases of each "fever" varies but slightly from year to year; and, therefore, the death-rate of each may be accepted as an index of the prevalence of that disease at the time. This assumption will be here used.

79. The charge that, "if smallpox is now less frequent, other eruptive diseases are more common,"

should hold good in one of three ways (*a*, *b*, *c*), each of which must be examined. It may be at once affirmed that there is no proof whatever to favour (*a*) the assertion that "vaccinated people are more liable to contract other fevers than the unvaccinated." Apparently, to both classes equally, do the other "fevers" happen. Such being the case, it necessarily follows that the vaccinated who are saved from smallpox will not remain exempt from other "fevers." (*b*) But in the absence of any hint even at a proof of the second statement that might be advanced, a categorical denial must be given to it. It would stand as follows:—"In contracting infectious diseases the vaccinated have them more severely, and die in greater proportion, than do the unvaccinated."

80. There remains then (*c*) the third possible assertion, that "when smallpox is rife other eruptive fevers are less frequent." This statement is opposed to facts. It is true that, if the last few weeks of the present epidemic be alone taken, at a first glance, smallpox seems for the present in London to have replaced the deaths from other diseases of the class. But the range of inquiry must be enlarged. In 1869 and 1870 there was an epidemic of scarlet fever of almost unexampled severity, and therefore, in accordance with the usual laws of epidemics, the metropolis is now enjoying some freedom from that complaint, which, since vaccination has been practised, is usually the most serious of all the "fevers." With the Registrar-General's mortality returns since 1853 before one, it is possible to trace the successive rise and fall of the principal infectious diseases. Smallpox was at its worst in 1855, 1859³, 1863⁴, 1866⁵, 1870⁶; *i.e.*, about every fourth year. Measles prevailed in 1858², 1860, 1862, 1864, 1866⁵, 1868, 1870⁶; every second year. Scarlet fever in 1854, 1859³, 1863⁴, 1869 and 1870⁶; about every fifth year. Whooping-cough in 1854¹, 1858², 1861, 1865 and

1866⁵, and 1869; about every third year. Often, it will be seen (from the corresponding small numerals placed above the years), that two epidemics raged in the same twelve months. And the last four epidemics of smallpox have been accompanied by a simultaneous prevalence of one or two of the other maladies. Epidemics of different diseases may rage together, or singly.

81. There remains, however, another point. As the population is larger than it would be without vaccination, the cases of "other eruptive diseases" (which happen equally to the vaccinated and unvaccinated) are just so many the more in the whole community, and the total deaths therefrom are consequently more than they would be, were smallpox still allowed to depopulate the country. As Mr. Simon admirably puts it:—"If vaccination on a given day in England secures a thousand lives against death by smallpox, sooner or later those lives will be subject to the inevitable lot; sooner or later the thousand deaths will be written against the names of other diseases than smallpox; and such diseases may then be said to have been rendered more frequent by vaccination. In the same sense every life that is snatched from fire, or flood, or poison, counts at last as a death from some other cause; and to say *in this sense* that such causes are more fatal than before vaccination, is but another form of saying, what Jenner would most have wished to hear, that smallpox is less fatal than it was." Certainly, in no other manner than this can vaccination be said to have rendered people more liable to infectious ailments, or eruptive diseases more common. Vaccination, in fact, does not render people immortal.

82. But the Board of Health papers conclusively show that all the chief causes of death have had for the last two centuries a slowly decreasing number of victims, except such diseases as apoplexy and paralysis,

which are the especial afflictions of old age, and are often the result of simple decay; and as vaccination has affected the death register more perhaps than any other single cause, this augmentation of deaths due to senile diseases speaks volumes in its favour. "The mortality of early life, and at all ages short of old age, has steadily diminished, and the number of persons who attain a good old age has as regularly increased."—(*Scaton.*) Again, "In London the annual death-rate from all causes, at the middle of the last century, was 355 per 10,000 of population; and from all causes, *except smallpox*, 325; but in the middle of the present century it was, *including smallpox*, but 249. In Sweden, in the period from 1755 to 1775, the general death-rate was 289 per 10,000 of the population; from 1841 to 1850 it was but 205. And similar results are obtained from the statistics of other countries." Macanlay, in describing the state of England towards the latter end of the seventeenth century, says it was a time "when men died faster in the purest country air than they now die in the most pestilential lanes of our towns, and when men died faster in the lanes of our towns than they now die on the coast of Guiana." Of course, no one would claim this improved sanitation as a result of vaccination only; but Jenner's discovery has not been the least of the good influences at work.

83. Still, even after this statistical proof concerning the diminished prevalence of all but senile diseases in the present day, there may yet be a lingering idea that in some few instances a constitutional malady has been set up by vaccination; for the onset of some other malady is occasionally coincident with the ingrafting of cowpox. The occurrence is, perhaps, mostly seen in the case of certain skin diseases. The statement appears to be based upon some truth; for it is allowed that the signs and symptoms of some

constitutional ailments already in the system, are not apparent until the body is thrown out of its usual course by an illness or accident. Probably, solely in so far as it is such a disturbing agent, can vaccination be credited with the creation of the maladies which are laid to its charge. That is, it may occasionally have expedited the outward manifestation of a disease latent in the organism of a child; much as April showers assist in the germination of seeds already sown in the earth. So much may perhaps be conceded. But as it is all that facts will substantiate, and is, moreover, a very rare event indeed, the objection to vaccination which is based upon the possibility of its occurrence is not worthy of the least practical regard when the abatement of the real and vast miseries of smallpox is to be considered.

84. But, surely, utopianism itself would scarcely expect that the thousands of lives (probably 60,000 in England alone) rescued yearly from smallpox by vaccination, through the instrumentality of fallible human hands, could be saved without the occurrence of a few such casual mischances.

85. Lastly, one perhaps cannot say that the event of healthy lymph setting up some disease other than cowpox is *impossible*; but if it is not exactly impossible, the proofs are quite wanting of its occurrence except in the rarest of cases. Indeed, medical men of the largest experience, physicians in family and consulting practice, private and public vaccinators, all coincide in regarding the possibility of such an event simply as a question of medical speculation; the probability of its occurrence in any special case, when the child to be vaccinated appears healthy, never for a single instant entering into their consideration. *The risk certainly is infinitesimal*, and practically may be disregarded. To healthy children, of whom proper care is taken, there seems to be no peril whatever. And *the vaccination of infants seen to be unhealthy is*

always to be postponed, and all the parties to the operation have a direct interest in such postponement—a circumstance which should restore confidence to parents who consider that their children are among those likely to be prejudicially affected by the process.

86. Now comes the question,—“Is any disease, other than cowpox, ever *conveyed from one child to another* by vaccination?” Here, again, one comes upon tangible ground, and can appeal to simple observation for the proof or disproof of the charge, whenever made. There is, of course, in each alleged case, the lymph-giving child to be examined; and if he has not the disease alleged to have been transferred, there is at once an end to the case. And one would have thought that, before making so serious an accusation against vaccination, people would have endeavoured to test its correctness by this simple expedient. But Dr. Seaton, writing in 1868, says that, “though he has carefully investigated a great number of such complaints of parents,” which came before him in his official capacity, he has “never yet in a single instance found that the child from whom the lymph was taken was suffering from the disease it was said to have imparted.” But upon taking the whole of the civilized world into account, one finds that in the millions upon millions of vaccinations that have been performed, an inoculable disease (characterized by a skin-eruption and other symptoms) which was unsuspectedly present in the child giving the lymph has, on eleven or twelve occasions altogether, accompanied the cowpox in those vaccinated therefrom. The cowpox and the other disease have each run their own special course. Twice only, and that recently, and upon grounds which as yet are inconclusive, has this accident been charged to vaccination in England. This is the only malady that anti-vaccinators now allege to be thus conveyed, and, therefore, the question of the transference of dis-

eases in general by the operation narrows itself to an inquiry into the cases when this special ailment is said to have been conveyed from child to child. "Was this malady then conveyed by the lymph only, or by some other channel?" Secondly, "Can the lymph from the vaccine vesicle of a diseased child convey a compound contagium of vaccinia and any other disease?" and, thirdly, "Is it possible, with the lessons of the past before them, for vaccinators exercising ordinary care to avoid such a *contretemps* in the future?"

87. In answer to the first query. In more than half these twelve cases a little of the blood of the diseased child is known to have been accidentally mixed with the lymph, through too deep a puncture of the vesicle by the surgeon; and it is highly probable that to this blood, and *not to the lymph*, the conveyance of the disease was due. And through a similar agency it is very strongly suspected the transference of the malady took place in the other cases; for an Italian physician, experimenting upon himself, introduced into a puncture on his own arm the lightest admixture of blood from a child thus diseased, with some cowpox lymph taken from a healthy subject. He first had vaccinia, and afterwards suffered precisely as the diseased child. Again, in olden times profitable to cuppers, it was by no means unknown for the operator to convey this same disease from one person to many others in the course of a single morning's round of visits.* Clearly, a want of sufficient care to free his instruments completely from blood after one cupping, before they were again used, was here the cause of the disaster. The perfection of vaccination consists in using only the limpid lymph

* For reference to this fact, mentioned in the English translation of Astruc's work (London, 1737), the author is much indebted to Mr. Simon.

from the vesicles, without a trace of blood. They may be punctured, and the contents as readily drawn off without injury to a subjacent blood-vessel as can the like proceeding be effected with a blister raised by a burn or a scald. The necessity for using lymph only, *uncontaminated with blood*, is, since the publication of the above sets of cases, fully recognized by vaccinators, so that, one may trust, the like accident by transplantation of blood will, at any rate, not recur.

88. Still, however, does that second question confront one, "Can vaccine lymph itself convey any other disease than cowpox?" It cannot be stated that *such conveyance* is impossible; but *amidst all the millions of vaccinations it has never been incontestably proved to have occurred*. And it is the opinion of physicians and surgeons, with scarcely an exception, that a decided negative is the true reply to the question.

89. Thirdly, "Is it possible for vaccinators, by the exercise of ordinary care, to engage that they will not transfer any disease (except vaccinia) from child to child, or in any other way harm an infant by vaccination?" Of course no operator dreams of using lymph from an infant that he even suspects to be diseased; to do so, would be to render himself guilty of as gross a piece of malpractice as was ever perpetrated. Can an operator, then, always tell whether the infant furnishing the vaccine virus is healthy? Undoubtedly, in the great majority of cases he can. And in the few remaining instances when he might perhaps pass an unhealthy child as healthy—instances so few that, judging from the records of the past, one may affirm it takes years in England to produce one solitary case that may turn out to be one of the kind—the adoption of a few simple precautions, such as that of only using instruments which are perfectly clean, of employing lymph quite free from the faintest

trace of blood, &c., renders well-nigh impossible the transference of any other disease in vaccination. Nevertheless, sadly exaggerated statements to the contrary are unfortunately swarming over the land, conveying to thousands of anxious fathers and mothers the impression that their young ones are liable in vaccination to receive all kinds of bodily troubles and disfigurements. It is time, then, for the friends of vaccination to make a stir, to assure the public that such alarms are unwarranted by anything which has occurred in the past, when the operation was often less accurately than it is now performed; whilst there is ample guarantee in the present greater knowledge of the medical profession that, in the future, vaccination will be still more nearly perfect. And Jenner's discovery is undoubtedly as worthy now, as at any time, of the very highest confidence of the people.

90. The very natural rejoinder that may be expected from any one reading the foregoing paragraphs is this: "Why, if there is the very faintest fear, when the virus comes from human sources, of its inoculating any other disease with cowpox,—why is not the lymph always taken direct from the cow for every vaccination?" There are certain grave objections to this so-called "*animal vaccination*," which may be summarized from the account given of them in the twelfth report of the Medical Officer of the Privy Council. The evidence upon the point was collected abroad in 1869 at certain towns "where a system is in vogue for maintaining continuous sources of lymph-supply for the human subject by keeping a succession of calves inoculated with the specific contagium." Failures in the endeavour to transmit successive vaccination from calf to calf are in the hands of the most expert operators very frequent; the absence of success in the attempted transference of infection from the calf to the human subject is nearly twenty times as great as in ordinary arm-to-arm vaccinations; and calf-

lymph is peculiarly apt to spoil with keeping, even when its preservation in tubes is attempted, so that the "Rotterdam establishment, in distributing supplies of lymph, now uses only lymph from the human subject." And lastly, the inflammation of the arm which accompanies a vaccination with "*animal lymph*" is much greater than that which arises when the process is accomplished with "*humanized lymph*."

91. Since the year 1853 the vaccination of infants has been made compulsory; much to the displeasure and indignation of some folk who preach defiance of the law and cease not to agitate for its repeal. But, if smallpox is to be annihilated, protection therefrom by cowpox must be universal; and, unless compelled, many at present would certainly go unvaccinated. Now, it surely is a wise provision of the legislature, and in entire accordance with the spirit of all sanitary laws, that a small temporary inconvenience should be borne in the unconscious and unemployed days of infancy, to avoid the great and fatal misery which a serious epidemic of variola causes amongst an adult working population. Where infantile vaccination is voluntary, and no compulsion exists, indifferent even more than prejudiced parents allow their child to go unprotected against variola; and he is liable to be cut off at the commencement of what might be to himself, to his friends, and to the State, a very useful life, not in consequence of his own omission, but through this culpable negligence of his natural protectors. And even if the child should not die from smallpox, it renders him at any rate a nuisance to others, who from him are liable to contract a fatal attack of the disease.

92. Agitators may prate of the "liberty of the subject," and so forth; but as the individual who has smallpox is a nuisance to other people, they might perhaps be allowed a voice in deciding whether he be

permitted to go unprotected against the disease. Yet this is not the gist of the compulsory law. The principle of that enactment is, that the State recognizes protection from smallpox by vaccination to be necessary to the child's well-being, "which a parent should not be entitled to withhold (any more than food or clothing) from his offspring."—(*Simon.*) The question is not, whether an adult shall be himself permitted to have smallpox, if such is his desire, but whether he shall have the option of allowing his children to suffer therefrom. Every one in the present day recognizes the right of the State to come between parent and child in other cases where harm might without such interference ensue to the child. Thus, the hours of labour in factories, &c., are, in "The Workshop Regulation Act," rigidly defined, according to the age of the worker; and employment in certain trades (melting and annealing of glass, and grinding in the metal trades) is forbidden to all below a certain age; and a penalty for infraction of the law is imposed upon the parent. Again, in the matter of education, the Act of 1870—not too soon—decrees that, whether the parent wills it or not, his young ones shall have a certain amount of instruction. Why then is not the Executive to provide also that which is quite as necessary to the child's existence as education or freedom from overwork? At any rate, the lives which the law, where fully carried out, has already grasped from the fatal influence of smallpox, form a guarantee that the compulsory enactments of 1853, which have since been rendered even more stringent, will not be lightened or repealed until men can show some other mode of prevention more efficacious for the purpose than cowpox.

93. But if the State decrees that infantile vaccination shall be compulsory, it is, at the least, bound to take full precautions that only the very best vaccination shall be practised. And such supervision is

exercised. "The Public Health Act of 1858" and "The Vaccination Act of 1867" require that every public vaccinator or his deputy shall have the highest qualifications for the post; and certain instructions, which are framed upon the most advanced knowledge of the subject, have been issued for the guidance of the public vaccinators, so as to insure the highest success in their proceedings. Thus, they are enjoined to vaccinate only those who are in good health; to take lymph only from well-characterized, uninjured vesicles in healthy subjects; to discard their lymph-stock and immediately obtain a fresh supply, if any symptoms of irregularity in the development of the vaccine vesicle manifest themselves; to keep all instruments used for vaccinating in the best condition; and to keep an accurate register of each case, its course, the source of the lymph with which it is vaccinated, the supply of lymph which it in turn furnishes, and so forth. Further, "every vaccination district in England is now visited once in every two years, the quality of its vaccination minutely examined by the Government Inspector, and all necessary advice and assistance given to local officers and authorities as to whatever may improve the vaccination." Besides, pecuniary rewards, amounting in the aggregate to nearly £4,000 per annum, are now made to meritorious vaccinators. The result of all this supervision is a yearly improving quality of public vaccination; so that, "whereas in 1867-8 first-class gratuities formed only *thirty-three* per cent. of the whole number of these awards, the first-class gratuities in 1869 formed *sixty* per cent. of all the awards."* It is as well that a knowledge of these matters should be made public, in order to re-assure people who may have been led to imagine that it is a mere matter of

* Annual Report (for 1869) of the Medical Officer of the Privy Council.

haphazard whether they receive good, indifferent, or even (as they fear) prejudicial vaccination, when they avail themselves at a public station of Jenner's great discovery.

94. No supervision of private vaccinators occurs ; but as they look to the public operators for the replenishment of their lymph-stock, when it fails, and as they often know (especially in small communities) the pedigree of the children, the offspring of their private patients, through whom they pass the virus, there is no reason why their performance of vaccination should be one whit less reliable than that of the public operators.

95. In passing, however, from the consideration of the foregoing highly-exaggerated objections to vaccination which result from the mistakes of the ignorant, and the misrepresentations of the designing, one encounters still a few real drawbacks, inseparable from its many advantages. Most of these have been incidentally touched upon in the preceding pages, but it will be useful to bring them together for final review. Vaccination, then, is the actual ingrafting of a constitutional disease upon a previously healthy body, which often produces for a few days much physical discomfort, both local and constitutional. It is consequently a serious affair, never to be undertaken by a person in bad health, except when he is incurring, in consequence of his unprotected condition, peculiar risk of smallpox (as in the present epidemic). Vaccination has, in rare instances, been accompanied by accidental complications, usually slight ; but which have been known to be severe, and, in the most exceptional cases, fatal. Then again, owing to anomalies of organization, the operation does not invariably give perfect protection from smallpox, whilst length of years seems to lessen even that security which may at first have been absolute. Vaccination appears, in

fact, to have just that tinge of imperfection which demonstrates its human parentage.

96. Now it must be remembered that *these are the sole drawbacks which can be legitimately advanced against vaccination*; and, when put together, to what do they amount in comparison with the loathsomeness and fatality of smallpox? They are far less serious than the objections that may be brought against the use of many a drug; yet who, because occasional deaths occur from the administration of chloroform, for example, would dream of setting aside that pain-killing agent, until a superior compound for the purpose is discovered? And chloroform is usually administered, merely to annul pain, whilst vaccination is used to preserve life.

97. Still, although the drawbacks are so slight, they must not be altogether ignored; and it is equitable to consider, without previous bias, the two sides of the question—to contrast the frightful deadly nature of unchecked smallpox with the few admitted imperfections of vaccination. When this is calmly done by any unprejudiced person capable of framing a logical deduction, it cannot be doubted that his verdict must be entirely with Jenner; and that he would consider even more serious measures than vaccination perfectly justifiable for the prevention of smallpox. Among the staunchest friends of vaccination are the greatest cultivators of medicine and science in all countries; men of the widest experience, capable of viewing the question dispassionately in all its lights, of forming a correct opinion in the matter, and perfectly free to state it. Is it likely that if they saw any flaw in the case for vaccination they would not long ago have detected it and traced it out to its ultimate bearings? Is not, then, the judgment of such talented men of science to be trusted by others who, from the nature of the case, can of their own experience know nothing certain respecting the subject?

Let those, then, who in the face of all this evidence still oppose vaccination, consider how far they are responsible for each death from smallpox, brought about by compliance with their illogical and ill-omened advice "not to vaccinate."

98. The medical profession has undoubtedly a very heavy responsibility in this matter. It is conclusive from the united testimony of all authorities upon the subject, that much of the outcry against vaccination arises from the imperfection of the operation. There has been too much of faulty vaccination in the past, and the present dreadful epidemic of smallpox should render surgeons fully alive to their obligations towards the public. This view of the question must not be neglected. Dr. Seaton has given it as his deliberate opinion that "people are now paying very dearly for the slipshod way in which vaccination has been performed. There has been something more than carelessness. Operators seem to have aimed at a sort of vaccination made easy."* Mr. Marson, nearly twenty years ago, wrote that "patients often present themselves with smallpox at the Hospital, who state they have been cut five, six, eight times, or more, for cowpox without effect. This is a great evil. It would happen but rarely in careful hands. Such persons think it is of no use having the operation tried again, that it will not take effect if they do, and ultimately they are attacked by smallpox, and perhaps die; whereas had they fallen into the hands of a good vaccinator, their lives would most likely have been saved."† "The worst enemies of vaccination are those who perform it ineffectually." Therefore, all laxity on the part of vaccinators, anything, indeed,

* "British Medical Journal," March 18, 1871.

† "Transactions of the Royal Medical and Chirurgical Society of London," vol. xxxvi.

which can in the least tend to bring the practice into disrepute, must be rigidly repressed. All purely personal considerations must be put aside to aid the public in stamping out variola. There must be a strict determination to exercise the greatest circumspection concerning each step of the operation, that it may be right well performed. Feeling the very heavy responsibility of their post, and guided in their vocation by perfect knowledge of their art, and by pure, unselfish motives, vaccinators will best disarm suspicion and silence all opponents.

99. But, numerous as have already been the lives preserved from untimely death, and amongst them, perchance, some of earth's greatest and best, it is allowable to hope and expect that, in the future, with more careful vaccination (for which there is a guarantee in the attention Government is now bestowing upon the subject) smallpox may be well-nigh eradicated. As a writer* has remarked:—"Whereas, in the ten years ending 1770 the deaths from smallpox in London amounted to 108 per thousand, they were gradually reduced to 11 per thousand in the ten years ending 1860. These are remarkable figures, but they are not such as would have satisfied the aspirations of Jenner, nor should they content us. We ought not to count our work done while anything remains to be accomplished."

100. It was Jenner's happy lot to stumble upon, and by his industry and talent to see established, during his own life, a proceeding which, with certain precautions, is an almost infallible safeguard against the worst pestilence in the world, a disease which is calculated to have destroyed annually, in Europe alone, its half-million of lives. To mankind he bequeathed his discovery. How then should his name

* "Medico-Chirurgical Review" for April, 1871.

be venerated ! Monuments are erected to selfish conquerors *destroying their tens of thousands* ; but surely the man who has *saved his millions* deserves something far superior at the hands of posterity ! And Jenner has this highest reward—*monumentum ære perennius* ; for in the silent affection and admiration of grateful men is cherished, for aye, the memory of that great physician and philanthropist.





